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Patent
Case No.: 59011US002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: CLEARY, JAMES D.
Application No.: 10/678841 Confirmation No.: 1146
Filed: October 3, 2003 Group Art Unit
Title: METHOD AND APPARATUS FOR BONDING ORTHODONTIC APPLIANCES
TO TEETH

BRIEF ON APPEAL

Mail Stop: Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an appeal from the Office Action mailed on July 5, 2006, in light of the Advisory Action mailed September 13, 2006, finally rejecting claims 43-52.

☐ Please charge the fee provided in 37 CFR § 41.20(b)(2) to Deposit Account No. 13-3723. One copy of this sheet marked duplicate is also enclosed.

☒ Any required fee will be paid at the time of EFS-Web submission.

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A Notice of Appeal in this application was mailed on September 29, 2006, and was received in the USPTO on September 26, 2006.

REAL PARTY IN INTEREST

The real party in interest is 3M Company (formerly known as Minnesota Mining and Manufacturing Company) of St. Paul, Minnesota and its affiliate 3M Innovative Properties Company of St. Paul, Minnesota.

RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals or interferences.

STATUS OF CLAIMS

Claims 43-52 are pending and stand rejected. Claims 1-42 have been withdrawn. Appellants also respectfully request that the typographical error in claim 43, line 7 be corrected by changing the comma at the end of line 7 to a semicolon.

STATUS OF AMENDMENTS

An Amendment After Final was submitted on September 5, 2006. In that amendment, claims 44 and 51 were amended to overcome a rejection under 35 U.S.C. §112, second paragraph. An Advisory Action was mailed on September 13, 2006, advising that applicant's reply has overcome the rejection under 35 U.S.C. §112, second paragraph and that the proposed amendment would be entered for purposes of appeal.

SUMMARY OF CLAIMED SUBJECT MATTER

The claims at issue concern methods of bonding orthodontic appliances to a patient's teeth by use of an array of solid state light emitters that is placed directly in the oral cavity. Independent claim 43 recites a method of bonding orthodontic appliances to a patient's teeth (e.g., page 4, line 16) comprising: providing orthodontic appliances (e.g., reference numeral 34a;

page 11, line 26 of the present specification) for at least two teeth of the patient's dental arch (e.g., page 4, line 18 of the present specification); providing a quantity of photocurable material for each appliance (e.g., page 8, line 23 and page 13, line 28 of the present specification); placing each orthodontic appliance on a corresponding tooth of the patient's dental arch such that the photocurable material is between the appliance and the tooth (e.g., page 4, line 20; page 8, line 22; and page 13, line 28 of the present specification); providing a substrate (e.g., reference numerals 12, 12a; page 5, line 24 and page 10, line 29 of the present specification) and an array of solid state light emitters mounted on the substrate (e.g., reference numerals 16, 16a; page 6, line 6 and page 12, line 15 of the present specification); placing the substrate and the array of light emitters in the oral cavity adjacent the orthodontic appliances such that the array of light emitters lie along a path that is located in an occlusal direction from the outer tips of the patient's teeth (e.g., page 9, line 7 and Fig. 4 of the present specification); and activating the light emitters in order to direct light from the light emitters in a gingival direction across the surfaces of the teeth and toward the photocurable material (e.g., page 9, line 14; page 9, line 21; and Fig. 4 of the present specification).

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 43-52 are unpatentable under 35 U.S.C. §103(a) over Cohen et al. (U.S. Patent No. 3,949,477) in view of Hare (U.S. Patent No. 5,316,473).

ARGUMENTS

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.” M.P.E.P. § 2143.

A) THE CITED DOCUMENTS DO NOT TEACH OR SUGGEST ALL THE LANGUAGE RECITED IN THE PRESENT CLAIMS.

It is respectfully submitted that the presently claimed invention is neither taught nor suggested by the combination of the references. That is, there is no teaching or suggestion in any document, considered alone or in any combination, that would provide a method of bonding orthodontic appliances by (a) placing an array of solid state light emitters mounted on a substrate in the oral cavity adjacent the orthodontic appliances such that the solid state light emitters lie along a path that is located in an occlusal direction from the outer tips of the patient's teeth, or (b) activating solid state light emitters in order to direct light from the emitters in a gingival direction across the surfaces of the teeth and toward photocurable material that is between the appliances and the teeth.

Cohen et al. discloses a method of bonding orthodontic appliances to teeth using radiant energy such as light or heat. In Figs. 1-5 of this reference, energy conductors 16 made of glass or fiber optic materials extend through an indirect bonding tray or transfer tray and terminate at a respective bracket, as described in column 2, lines 65-69. The drawings show the conductors 16 extending through the tray or mold 15 in a lingual direction (i.e., in a direction toward the patient's tongue). Consequently, when energy such as light is emitted from the conductors 16, the energy is directed in a lingual direction to the respective bracket 14.

In Figs. 1-5 of Cohen et al., it is clear that the source of radiant energy 17 is located outside of the oral cavity. Moreover, Cohen et al. does not disclose the use of solid state light emitters. (In the present application, the phrase "solid state light emitters" is defined on page 7, line 3 as any device that converts electrical energy into electromagnetic radiation through the recombination of holes and electrons, such as LEDs, laser diodes, and electroluminescent devices.)

In the embodiment shown in Fig. 6 of Cohen et al., a single radiant energy source 17a is provided and includes a probe 16a. Column 3, lines 65-69 mentions that the mold 15a may be transparent. However, in Fig. 6 there is no array of light sources. Further, there is no indication that the energy source 17a is located in the oral cavity. Instead, the Cohen et al. patent indicates that radiant energy source 17a "may assume the configuration of a gun" (column 3, lines 59-60),

and provides a probe 16a. Presumably, the probe 16a is provided for enabling the gun to be located outside of the oral cavity in use.

In the embodiment shown in Fig. 7 of Cohen et al., energy source 17b is connected by stem portion 21b to a radiant energy conductor 16b. However, energy conductor 16b extends along the buccolabial side (i.e., the side facing the patient's lips or cheeks) of the mold 15b. In Fig. 7, there is no indication that the energy source 17b is in the oral cavity, and in all likelihood is kept outside of the oral cavity due to the provision of stem portion 21. The embodiment of Fig. 7 also does not include an array of light sources, let alone an array of solid state light emitters.

None of the embodiments described in Cohen et al. suggest the act of providing a substrate and an array of solid state light emitters mounted on a substrate. Moreover, none of the embodiments in Cohen et al. suggest the act of placing an array of light emitters in the oral cavity adjacent orthodontic appliances such that the array of light emitters lies along a path that is located in an occlusal direction from the outer tips of the patient's teeth. Although the Examiner indicated in the Office Action dated July 5, 2006 (see Appendix of Cited Documents) that in Cohen et al the light emitters "lie along a path that is located in an occlusal direction. . ." (see page 2, paragraph 4 of that Office Action), such is not the case. Instead, Cohen et al. describe apparatus having light or heat sources that are located along the buccolabial or facial side of the patient's teeth.

Furthermore, Cohen et al. attempt to place light conductors 16 as close to the brackets as possible. See, e.g., column 3, lines 36-40 where it is stated that "[t]he conductors 16 may terminate at a position *contiguous to and along side* of a respective bracket 14 . . ." (emphasis added). Cohen et al. do not recognize any advantage in keeping the light sources in locations that are spaced away from the appliances, or in locating the light sources in an occlusal direction from the outer tips of the patient's teeth.

In addition, none of the embodiments described in Cohen et al. teach a method of orthodontic bonding wherein light is directed from solid state light emitters in a gingival direction across the surfaces of the teeth and toward photocurable material. By contrast, Cohen et al. teach the concept of apparatus that directs light or heat in a lingual direction toward orthodontic appliances.

The '473 Hare patent is directed to dental apparatus for light curing of dental impression material. This reference is not directed toward orthodontic methods of bonding orthodontic appliances to teeth. The Hare patent is also not concerned with curing orthodontic adhesive that lies between brackets and teeth. Impression trays of the type shown in the Hare patent are not normally used with patients that have orthodontic brackets since the impression material would tend to be torn and consequently distorted by the brackets when the impression material is pulled away from the teeth.

Moreover, the Hare patent is not concerned with bonding anything to teeth. By contrast, impression materials should not bond to teeth when curing since any bonded materials would tend to fracture when removed from the dental arch. It is important when taking an impression that the resulting impression accurately represents the configuration of the patient's teeth. As a result, bonding of the impression material to teeth has long been avoided so that the resulting impression is not torn or otherwise damaged when it is removed from the oral cavity.

The Hare patent does not teach a method of orthodontic bonding, and additionally does not teach a method of orthodontic bonding wherein light is directed in a gingival direction and across the surfaces of the teeth toward photocurable material. Hare does not recognize the benefits achieved by the orthodontic bonding methods of appellant's claims. Instead, the Hare patent is concerned with distributing light in a uniform manner to impression material located in an impression tray. See, e.g., column 8, lines 43-47 of the Hare patent.

The present invention provides a number of significant advantages that are neither taught nor suggested by the references of record. For example, by retaining light emitters in a location that is in an occlusal direction (i.e., in a direction away from the gingiva or gums) from the outer tips of the patient's teeth during an orthodontic bonding procedure, it is less likely that the light emitters will contact the appliances and move the appliances from a previously selected location before such time as the bonding material has hardened. Orthodontic practitioners often go to great lengths in placing the appliances in precise positions on the teeth, and consequently it is advantageous to avoid exposing the appliances to forces that might move the brackets from their intended locations before the bonding adhesive has cured. Furthermore, by keeping the light emitters in a location that is in an occlusal direction from the outer tips of the patient's teeth, it is less likely that the light emitters will come into contact with the patient's saliva and push the

saliva toward the area of bonding, where it could come into contact with the adhesive and adversely affect the ultimate bond strength of the appliances to the teeth.

Additionally, the methods of the appellant's claims are advantageous because there is more free space available to place light emitters and a substrate in the patient's oral cavity in a location adjacent the occlusal tips of the teeth. This is in contrast to conventional methods of using curing lights having a light outlet that is placed between the appliances and the patient's lips or cheeks. As a result, by practicing the present invention a substrate with light emitters can be constructed to provide a universal fit for a variety of patients, regardless of the overall size of the patient's dental arches. These advantages are especially important when bonding appliances in posterior regions of the patient's oral cavity where free space is very limited.

Moreover, the present methods of bonding orthodontic appliances are advantageous because a portion of the light emitted from the light emitters is transmitted in direction generally along the front surfaces of the patient's teeth. These methods tend to trans-illuminate the teeth, which in turn facilitates the travel of light to the photocurable material located between the appliances and the surface of the teeth. Light that is traveling in a gingival direction and along the labial surfaces of the patient's teeth is not blocked by the appliances. As a result a greater amount of light may reach the photocurable material.

In the past, bonding orthodontic appliances to teeth using photocurable material has been typically carried out by directing light in a lingual direction as described in the Cohen et al. patent. Often, the practitioner would aim a light curing unit or gun toward the mesial and distal sides of the bracket in order to cure adhesive along the edges of the bracket. However, orthodontic appliances that are opaque will block the transmission of light and hinder the curing of orthodontic adhesive that is located in the shadow of the appliances. The bonding methods of appellant's claims provide a significant advantage, in that light is directed across the surfaces of the teeth in a gingival direction in order to bond appliances to teeth.

B) THERE IS NO SUGGESTION OR MOTIVATION TO COMBINE THE CITED DOCUMENTS TO ARRIVE AT THE PRESENT INVENTION.

Appellants respectfully submit that there is no suggestion or motivation, either in the documents or in the knowledge generally available to one of ordinary skill in the art, to modify

the methods taught by these references. Cohen et al., as discussed above, do not teach a method of bonding orthodontic appliances using solid state light emitters located in the oral cavity. Cohen et al. teach that the light source should be directed from a location outside of the oral cavity and that the light should be directed in a lingual direction. Cohen et al. also teach that their light conductors should be located as close to the orthodontic appliances as possible. Cohen et al. do not recognize any reason to locate light emitters in an occlusal direction from the outer tips of the patient's teeth. Additionally, Cohen et al. do not describe the problems presented when attempting to bond photocurable materials that are located beneath opaque orthodontic appliances such as brackets, or recognize that the brackets may create a shadow effect that blocks transmission of light.

Hare, as discussed above, is not directed toward methods of bonding orthodontic appliances to teeth and instead is directed toward apparatus for curing impression materials. One attempting to increase the reliability of a bond between an orthodontic appliance and a patient's tooth would not turn to the Hare patent that relates to impression materials, because impression materials should not be bonded to teeth. Consequently, one skilled in the art would not be inclined to attempt to improve orthodontic bonding methods by hypothetically combining the two cited references.

***C) THE EXAMINER IS ENGAGING IN IMPERMISSIBLE HINDSIGHT
RECONSTRUCTION***

In the present case, the Examiner has found references that describe component parts of apparatus used for curing photocurable materials. However, the present claims are directed toward methods of bonding orthodontic appliances to teeth, and not toward a hypothetical apparatus. The references simply do not teach or otherwise suggest the bonding methods set out in appellant's claims.

It is submitted that the rejection may only be made by impermissible hindsight reconstruction; that is, by picking and choosing components from each document that supports the rejection. However, one cannot "simply [to] engage in a hindsight reconstruction of the claimed invention, using appellant's structure as a template and selecting elements from

references to fill in the gaps”. *In re Gorman*, 933 F.2d 982, 18 USPQ 2d 1885, 1888 (Fed. Cir. 1991).

As recently asserted in *Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.* 411 F.3d 1332, 75 USPQ 2d 1051 (Fed. Cir. 2005), 35 U.S.C. §103 specifically requires an assessment of the claimed invention “as a whole”. The “as a whole” assessment of the invention requires a showing that an artisan of ordinary skill in the art at the time of the invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the various elements from the cited references and combined them in the claimed manner. In other words, 35 U.S.C. §103 requires some suggestion or motivation, before the invention, to make the combination. See *In re Rouffet*, 149 F.3d 1350, 1355-56, 47 USPQ 2d 1453, 1457-58 (Fed. Cir. 1998).

This “as a whole” instruction in 35 U.S.C. §103 prevents evaluation of the invention part by part. Without this important requirement, an obviousness assessment could successfully break an invention into its component parts, then find a reference corresponding to each component. This line of reasoning would import hindsight into the obviousness determination by using the invention as a roadmap to find its prior art components. Further, this improper method would discount the value of combining various existing features of principles in a new way to achieve a new result – which is often the essence of the invention. *Ruiz v. AB Chance Co.*, 357 F.3d 1270, 1275, 69 USPQ 2d 1686, 1690 (Fed. Cir. 2004). Simply identifying the various elements of a claim in the cited reference does not render a claim obviousness. *Ruiz*, 357 F.3d at 1275. Instead, 35 U.S.C. §103 requires some suggestion or motivation in the prior art to make the new combination. *In re Rouffet*, 149 F.3d at 1355-56. Appellants submit that the Examiner has engaged in an improper part by part analysis of the claimed methods and that the requisite motivation to combine the teachings of the cited references to obtain the claimed invention, as a whole, is lacking.

CONCLUSION

For at least the reasons presented above, appellants respectfully submit that the Examiner has failed to establish a *prima facie* case of unpatentability of claims 43-52. Review and reversal by the Board of the rejection under 35 U.S.C. §103(a) of claims 43-52 is respectfully requested.

Respectfully submitted,

November 29, 2006

Date

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CLAIMS APPENDIX

1-42 (cancelled)

43.(previously presented) A method of bonding orthodontic appliances to a patient's teeth comprising:

- providing orthodontic appliances for at least two teeth of the patient's dental arch;
- providing a quantity of photocurable material for each appliance;
- placing each orthodontic appliance on a corresponding tooth of the patient's dental arch such that the photocurable material is between the appliance and the tooth;
- providing a substrate and an array of solid state light emitters mounted on the substrate,
- placing the substrate and the array of light emitters in the oral cavity adjacent the orthodontic appliances such that the array of light emitters lie along a path that is located in an occlusal direction from the outer tips of the patient's teeth; and
- activating the light emitters in order to direct light from the light emitters in a gingival direction across the surfaces of the teeth and toward the photocurable material.

44. (previously presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 43 wherein the substrate comprises an indirect bonding placement device.

45. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 44 wherein the placement device comprises a shell having an overall, generally "U"-shaped configuration in plan view.

46. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 44 wherein the placement device has a channel that corresponds to the shape of at least a portion of the patient's dental arch, and wherein the array is located adjacent the channel.

47. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 46 wherein the array extends along a longitudinal axis of the channel.

48. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 43 wherein the act of activating the light emitters includes the act of directing light through a light-transmissive matrix material.

49. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 43 and including the act of holding the substrate by clamping the substrate between the upper and lower teeth of the patient.

50. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 43 wherein the substrate is generally flat.

51. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 43 wherein the substrate has a curved longitudinal axis.

52. (Previously Presented) A method of bonding orthodontic appliances to a patient's teeth according to claim 43 wherein the substrate has an overall length that generally matches the length of a quadrant of the patient's dental arch.

EVIDENCE APPENDIX

1. U.S. Patent No. 3,949,477 (Cohen et al.).

First cited by the Examiner on page 2 of the Office Action mailed January 11, 2005.

2. U.S. Patent No. 5,316,473 (Hare).

First cited by the Examiner on page 2 of the Office Action mailed January 10, 2006.

3. Final Office Action mailed July 5, 2006 in connection with the present application (Serial No. 10/678,841).

4. M.P.E.P. §2143 (Eight Edition, August 2005 Revision).

5. *In re Gorman*, 933 F.2d 982, 18 U.S.P.Q.2d 1885, 1888 (Fed. Cir. 1991).

6. *Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.*, 411 F.3d 1332, 75 U.S.P.Q.2d 1051 (Fed. Cir. 2005).

7. *In re Rouffet*, 149 F.3d 1350, 1355-56, 47 U.S.P.Q.2d 1453, 1457-58 (Fed. Cir. 1998).

8. *Ruiz v. A.B. Chance Co.*, 357 F.3d 1270, 1275, 69 U.S.P.Q.2d 1686, 1690 (Fed. Cir. 2004).

[54] **ORTHODONTIC METHOD AND APPARATUS**

3,738,005 6/1973 Cohen et al. 32/14 B
3,745,653 7/1973 Cohl 32/14 A

[76] Inventors: **Morton Cohen**, Fox Pavilion, Suite 604, Jenkintown, Pa.; **Elliott Silverman**, 4829 Atlantic Ave., Ventnor, N.J.

Primary Examiner—Louis G. Mancene
Assistant Examiner—Jack Q. Lever

[22] Filed: Nov. 18, 1974

[21] Appl. No.: 524,470

[52] U.S. Cl. 32/14 A

[51] Int. Cl.² A61C 7/00

[58] Field of Search 32/14 A, 14 B, 14 R, 14 C, 32/14 E

[56] **References Cited**

UNITED STATES PATENTS

3,452,436 7/1969 De Woskin 32/14 A

[57] **ABSTRACT**

In the application of orthodontic brackets to teeth by the indirect method employing a transfer tray, the use of adhesive activating radiant energy passing through the transfer tray or mold and apparatus for conducting the radiant energy from the mold or exteriorly thereof, through the latter to the bracket adhesive to be activated.

13 Claims, 7 Drawing Figures

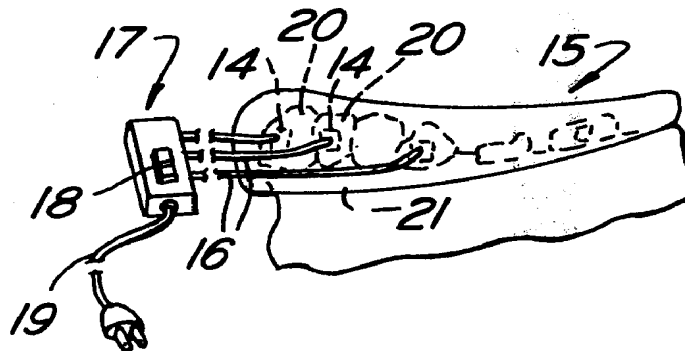


FIG. 1

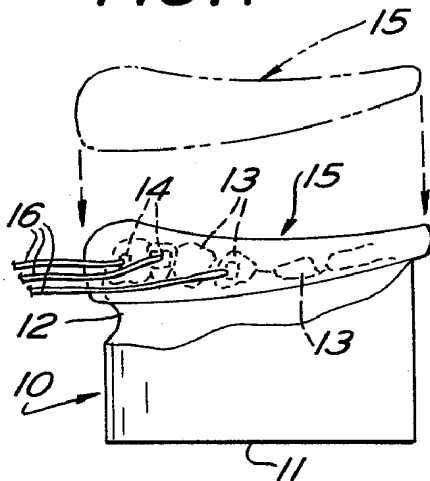


FIG. 2

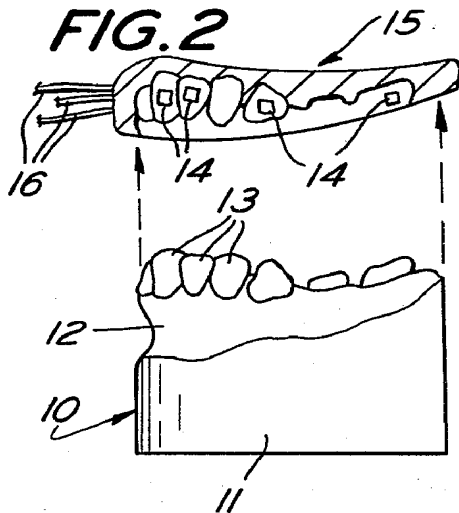


FIG. 3

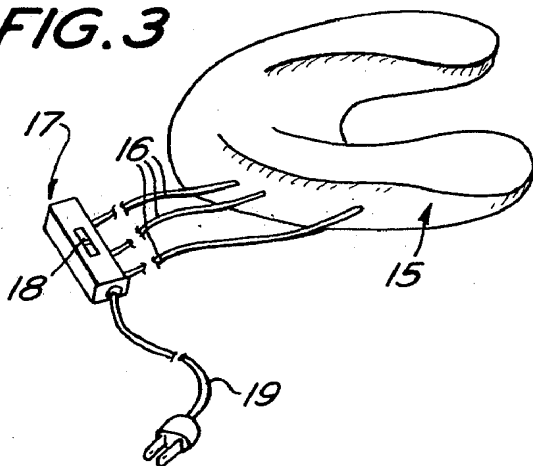


FIG. 4

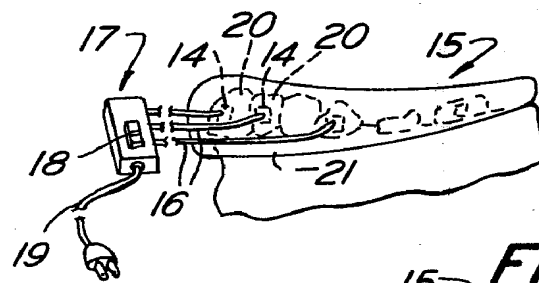


FIG. 5

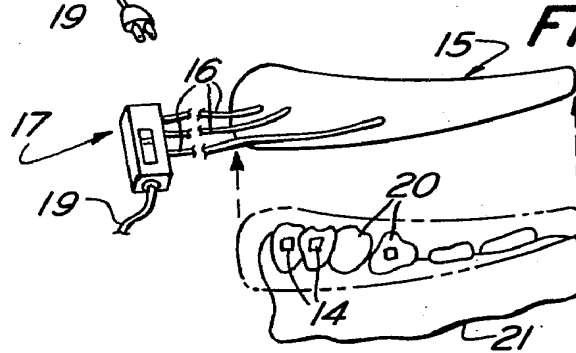


FIG. 6

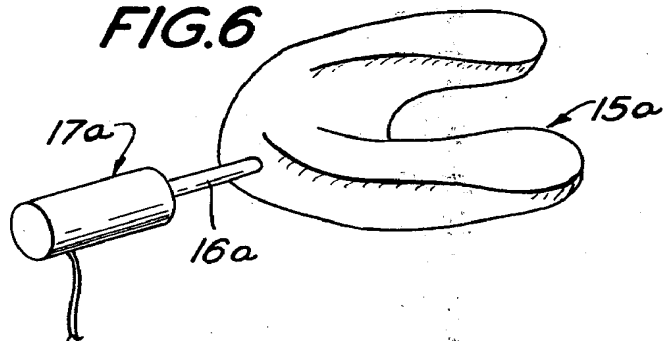
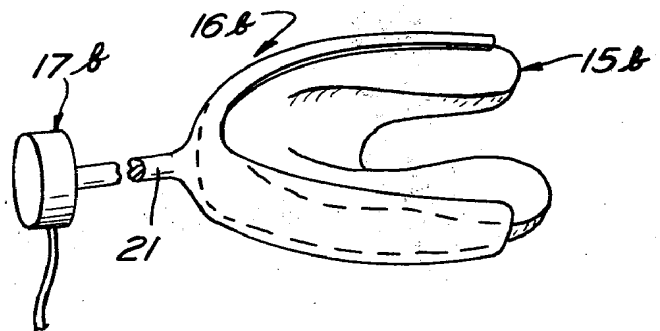


FIG. 7



ORTHODONTIC METHOD AND APPARATUS

BACKGROUND OF THE INVENTION

The present invention constitutes an improvement over the invention of our prior patent U.S. Pat. No. 3,738,005, wherein adhesive curing was not accurately controllable as to occurrence, both commencement and duration of adhesive curing being inherent in the method rather than selectively controllable. This lack of accurate control of the adhesive required relatively high skill of the practitioner.

SUMMARY OF THE INVENTION

It is an important object of the present invention to provide an orthodontic method and apparatus for applying brackets to teeth which is highly simplified so as to require relatively little skill of the practitioner, while being assured of highly accurate results.

It is a further object of the present invention to provide a unique method and apparatus for applying orthodontic brackets which is extremely quick, sure and highly reliable so as to save considerable time to both patient and practitioner, without sacrificing quality of work and results.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combination and arrangements of parts and method steps, which will be exemplified in the following description, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view showing a dental cast and a positioner, mold or tray having been applied to the dental cast, the positioner being shown in phantom apart from the dental cast.

FIG. 2 is an elevational view similar to FIG. 1, showing the dental cast and positioner, the latter being shown partially in section as having been removed from the dental cast.

FIG. 3 is a top perspective view showing the positioner, mold or tray apart from the dental cast.

FIG. 4 is a partial side elevational view showing the positioner of FIGS. 3 and 2, as applied to a patient's teeth.

FIG. 5 is an elevational view similar to FIG. 4, but illustrating the positioner having been removed from the patient's teeth while the orthodontic brackets remain positioned on the teeth.

FIG. 6 is a top perspective view showing a positioner, mold or tray of the present invention including a slightly modified embodiment of adhesive activating means.

FIG. 7 is a top perspective view showing another slightly modified positioner, mold or tray of the present invention including a further modified activating means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, and specifically to FIG. 1 thereof, a dental cast is there generally designated 10, which of itself may be conventional, being formed of plaster to accurately simulate

the gums and teeth of a patient. The dental cast 10 includes a base part 11, a gum simulating region 12 extending from the base, and simulated teeth 13 projecting from the gum simulating region 12. Thus, the simulated teeth 13 and gum region 12 are an accurate model of the patient.

With the dental cast 10, the orthodontist may determine the optimum locations and arrangements of dental brackets. That is, the orthodontist may choose the proper type of bracket and select an optimal location and arrangement on the teeth. It will be seen that certain of the teeth 13 carry brackets 14, the latter being selectively positioned on the teeth. The brackets 14 on the teeth 13 of the dental cast 10 are detachably or removably positioned, as by wax, a tacky adhesive or other suitable means.

With the brackets 14 selectively positioned and detachably secured to the dental cast teeth 13, a quantity of molding material in a plastic condition is conformably applied to the teeth 13, brackets 14 and adjacent portions of the gum simulating region 12. The molding material may be of any suitable type, and it has been found satisfactory to employ thermoplastic material in a heated or plastic condition for convenient moldability into conforming engagement with the cast teeth 13, brackets 14 and adjacent portions of the gum region 12. The molded material is shown in solid lines in FIG. 1 as a mold, positioner or tray 15, which is of a flexible, self-sustaining, resilient character and has been molded into positive, capturing engagement with the brackets 14. For example, the material of mold 15 extends into undercuts of the brackets 14 so as to capture and releasably retain the latter.

In addition, there are provided one or more radiant energy conductors 16 extending from the exterior of mold 15 inwardly therethrough, being embedded therein, and each terminating adjacent to a respective bracket 14. The conductors 16 may be of glass or fiber-optic type for conducting light, metal for conducting heat, or other suitable radiant energy conductive material. In practice, the conduction of light, and particularly light in the ultraviolet range, has been found advantageous, for reasons which will appear presently. Exteriorly of the mold, tray or positioner 15, the radiant energy conductors 16 may be connected to a source of radiant energy, such as a source 17, see FIG. 3 which may be an ultraviolet light source, heat source, ultrasonic sound source, or other. The radiant energy source 17 may be provided with an actuating means or switch 18, and a supply cord 19 for connection to a power source.

Upon withdrawal of the mold 15 from the dental cast 10, as from the solid line position of FIG. 1 to the phantom position thereof, the brackets 14 are removed from the dental cast teeth 13 by the positive action of the mold. That is, the brackets 14 are retained by the mold 15 upon its removal from the dental cast 10, the temporary retaining means employed to position the brackets being insufficient to retain the brackets against the positive withdrawing force of the mold 15. The mold 15 is shown in detail in FIG. 3, where it will be observed that the mold has captured interiorly thereof the brackets 14, the latter being releasably but positively retained in position within the mold by engagement of the mold material in undercuts of the bracket. The several radiant energy conductors 16 each extend through the mold 15 to terminate at a respective bracket 14, for purposes appearing more fully hereinafter.

As shown in FIG. 3, the mold 15 apart from the dental cast 10 transports the captured brackets, and positions the latter properly on the patient's teeth, as shown in FIG. 4.

Before actual location of the mold 15 in conforming engagement with the patient's teeth 20 and adjacent gum portion 21 of the patient, the teeth are dried, or otherwise prepared to receive a chemical adhesive or component thereof, placed on either or both of the brackets 14 and patient's teeth 20. In practice, a sealant has been placed on the patient's teeth, such as the adhesive sealant sold under the trademark Nuva Seal by Dentsply Corp., which sealant is sensitive to ultraviolet light and may or may not be polymerized at this stage, as desired. The contact surfaces of the brackets 14 captured within the mold or tray 15 may have applied thereto a chemical adhesive, such as Nuva Tach, an adhesive cooperable with Nuva Seal to cure in response to activation by ultraviolet light. The product Nuva Tach is also an adhesive product of Dentsply Corp. However, other remotely activatable adhesive systems may be employed, as desired.

The tray or mold 15, with the bracket contact surfaces having an adhesive material applied thereto, is placed in position on the patient's teeth which automatically and simultaneously properly locates all of the brackets, each in facing relation with a respective tooth, and the mold, positioner or tray is in conforming engagement with the teeth and gums.

Curing or setting of the adhesive is then occasioned at a selected point in time by actuation of the activator 17, which may be an ultraviolet light source transmitting ultraviolet radiation through conductors 16 to respective brackets 14 for curing the adhesive interposed between the associated bracket and adjacent tooth. The conductors 16 may terminate at a position contiguous to and along side of a respective bracket 14 for transmitting radiant energy to the adhesive material, or the brackets may be permeable to the radiant energy, as by transparency or perforations.

As selectively activatable material cures or sets faster and the commencement of curing is selected by the operator, it will be understood that precision of bracket location is assured with a minimum of difficulty, even when performing upon youngsters.

After curing or setting of the adhesive to securely fasten brackets 14 to the patient's teeth 20, the positioner, mold or tray is withdrawn or removed from the conforming engagement of FIG. 4, as in the direction of arrows in FIG. 5. The positioner, mold or tray 15 may be suitably flexed, as required, to release the brackets, which are now fixedly secured in their precise selected positions on their respective teeth, as shown in FIG. 5. Necessary wiring and other orthodontic procedures may now be performed.

Referring now to the embodiment of FIG. 6, it will there be seen that a mold, tray or positioner 15a is provided which may be generally identical to the tray 15. However, the radiant energy source 17a may assume the configuration of a gun, being provided with a probe 16a for conducting radiant energy. The probe 16a may be inserted into the mold or tray 15a for conduction of radiant energy through the mold to each bracket and its associated adhesive.

Also in the embodiment of FIG. 6, the mold 15a may be transparent or permeable to the radiant energy, whereupon the probe 16a need not enter the mold to pass the energy through the mold.

A further embodiment is shown in FIG. 7, wherein a mold 15b is fabricated of material permeable to radiant energy, such as material transparent to ultraviolet light. A radiant energy conductor 16b may assume a general U-shaped overall configuration for close circumposition about the mold 15b, and may be connected, as by a stem portion 21 to a radiant energy source 17b. Thus, radiant energy may be transmitted simultaneously through the entire mold 15b, or such lesser part thereof as desired, to activate the adhesive, as described hereinbefore, without physical penetration of the mold.

It is now seen that the present invention provides a uniquely improved method and apparatus for more quickly and easily applying orthodontic brackets to a patient's teeth, in accurately positioned relation, and which otherwise fully accomplishes its intended objects.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What is claimed is:

1. In an orthodontic method, the steps which comprise: making a dental cast of the patient, selectively positioning and detachably applying brackets to the dental cast positioned as desired on the patient's teeth, applying a molding material into conforming engagement with the dental cast and brackets to define a mold which assumes the configuration of the dental cast and captures the brackets, removing the mold and captured brackets from the dental cast, applying said mold and brackets to the patient's teeth with selectively activatable adhesive interposed between the brackets and teeth, activating the adhesive by passing activating energy through the mold to secure the positioned brackets to the teeth, and removing the mold from the teeth while leaving the brackets secured.
2. The orthodontic method according to claim 1, further characterized in activating said adhesive by passing radiant energy through said mold.
3. The orthodontic method according to claim 2, further characterized in passing said radiant energy optically.
4. The orthodontic method according to claim 3, further characterized in passing said radiant energy through conductive paths in said mold directed at said adhesive.
5. The orthodontic method according to claim 1, further characterized in applying light activatable adhesive between said brackets and teeth, and passing light energy through light conductive means in said mold.
6. The orthodontic method according to claim 5, further characterized in passing ultraviolet light energy.
7. Orthodontic apparatus comprising, in combination, a dental cast of a patient, a plurality of brackets removably applied to the teeth of said dental cast at selected locations thereon, a positioner in conforming engagement with said dental cast teeth and applied brackets for removal together with said brackets from said teeth, said positioner with said brackets being conformably engageable with the patient's teeth to selectively locate the brackets in facing relation with the patient's teeth, energy activatable adhesive interposable between the brackets and patient's teeth for effecting securement therebetween, and selectively operable activating means penetrating through said

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positioner for selectively activating said adhesive, said activating means comprising energy conductive means in said positioner for conducting energy to the adhesive, whereby the positioner can be placed on the patient's teeth, the adhesive activated through the activating means thereby securing the brackets to the teeth and allowing the positioner to be removed leaving the brackets selectively located on the patient's teeth.

8. Apparatus according to claim 7, said adhesive being activatable by radiant energy, and said activating means comprising a radiant energy source, and radiant energy transmission means for delivering energy to said adhesive.

9. Orthodontic apparatus according to claim 8, said adhesive being light activatable, and said activating means comprising a light source, and a light conducting means communicating between said source and said adhesive for conducting light to the latter.

10. Orthodontic apparatus comprising, in combination, a dental cast of a patient, a plurality of brackets removably applied to the teeth of said dental cast at selected locations thereon, a positioner in conforming engagement with said dental cast teeth and applied brackets for removal together with said brackets from said teeth, said positioner with said brackets being conformably engageable with the patient's teeth to selectively locate the brackets in facing relation with the patient's teeth, selectively activatable adhesive interposable between the brackets and patient's teeth,

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for effecting securement therebetween, and selectively operable activating means penetrating through said positioner for selectively activating said adhesive, whereby the positioner can be placed on the patient's teeth, the adhesive activated through the activating means thereby securing the brackets to the teeth and allowing the positioner to be removed leaving the brackets selectively located on the patient's teeth, said adhesive being activatable by radiant energy, and said activating means comprising a radiant energy source, and radiant energy transmission means for delivering energy to said adhesive, said adhesive being light activatable, and said activating means comprising a light source, and a light conducting means communicating between said source and said adhesive for conducting light to the latter, said light conducting means comprising elongate optical elements embedded in said positioner.

11. Orthodontic apparatus according to claim 10, said light source being of ultraviolet light.

12. Orthodontic apparatus according to claim 9, said light conducting means comprising a probe insertable into said positioner for conducting light through the latter to a selected bracket and its associated adhesive.

13. Orthodontic apparatus according to claim 9, said positioner being transparent, and said light conductive means comprising an arcuate segment in conforming relation with said positioner.

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United States Patent [19] Hare

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[45] Date of Patent: May 31, 1994

[54] LIGHT CURING APPARATUS AND METHOD

[75] Inventor: Robert V. Hare, Georgetown, Del.

[73] Assignee: Dentsply Research & Development Corp., Milford, Del.

[21] Appl. No.: 873,909

[22] Filed: Apr. 24, 1992

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 609,036, Nov. 5, 1990, abandoned, which is a continuation of Ser. No. 208,201, Jun. 17, 1988, abandoned.

[51] Int. Cl.⁵ A61C 1/00; A61C 3/00; A61C 5/00; A61C 9/00

[52] U.S. Cl. 433/29; 433/215; 433/229; 433/37

[58] Field of Search 433/25, 29, 30, 37, 433/215, 229; 362/806, 811, 362; 385/104, 111, 120; D26/2, 3, 27

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Primary Examiner—Gene Mancene

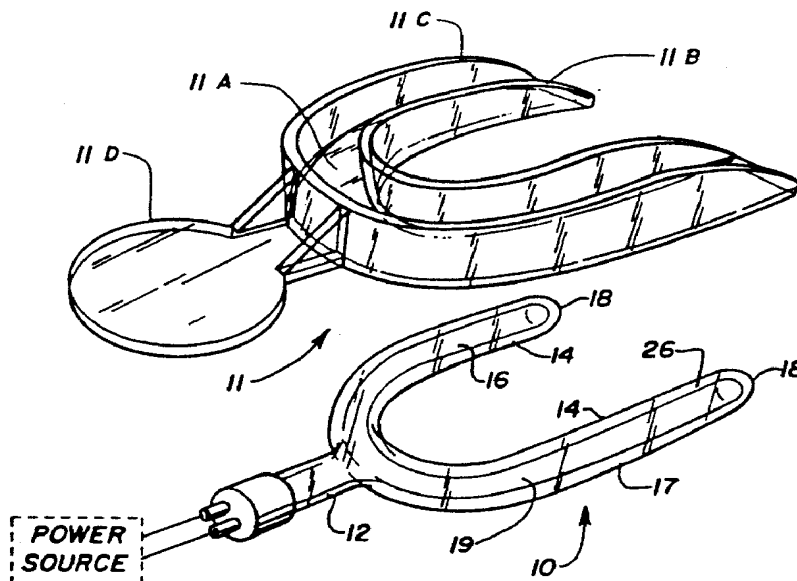
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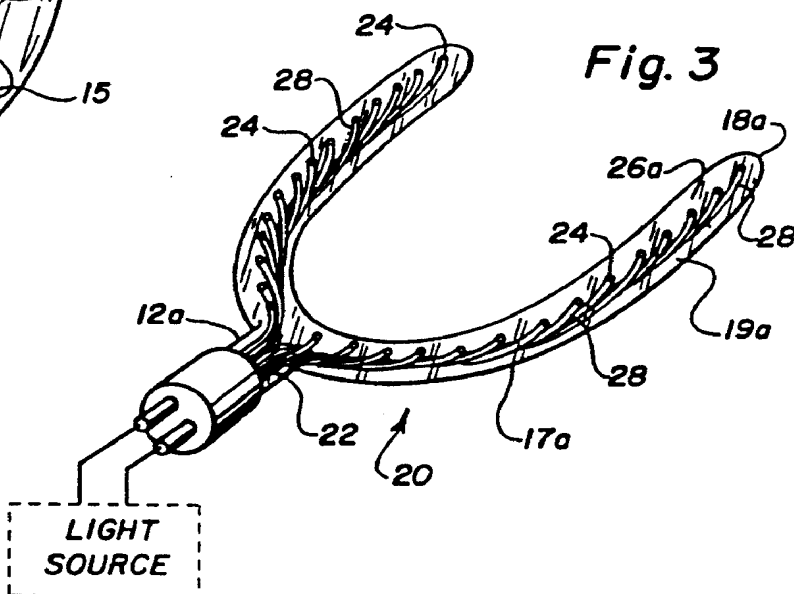
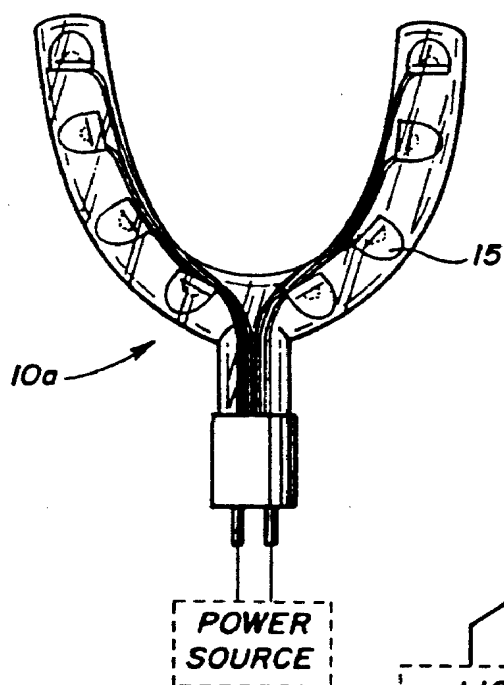
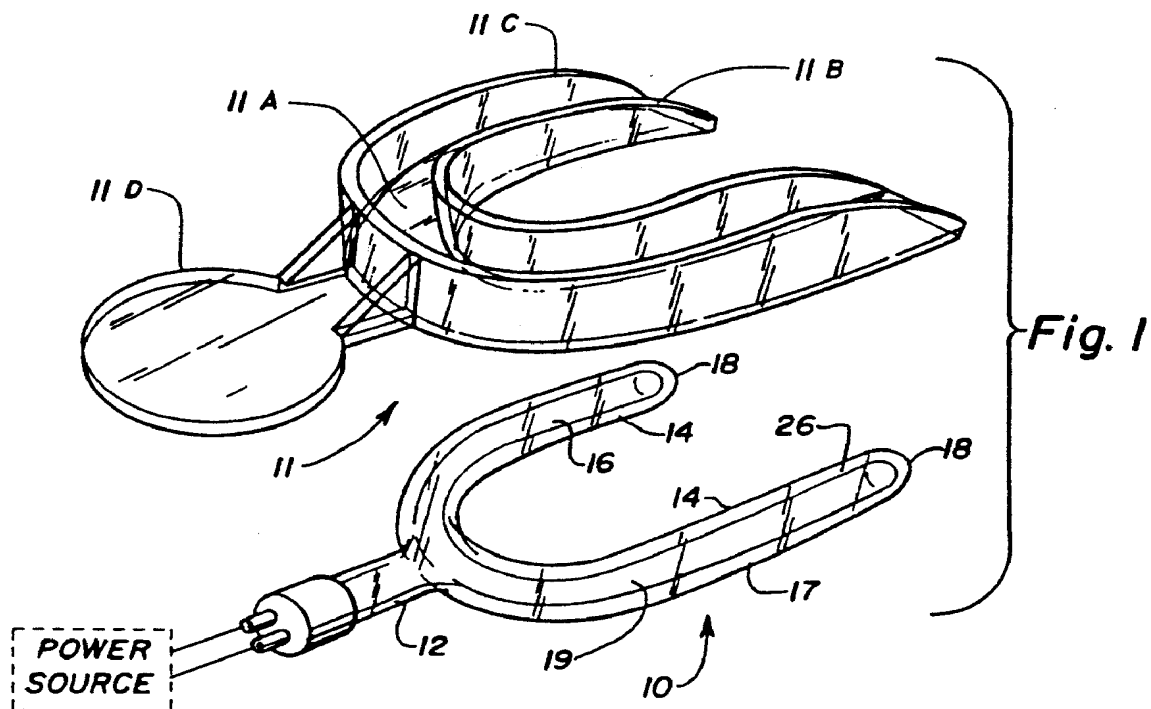
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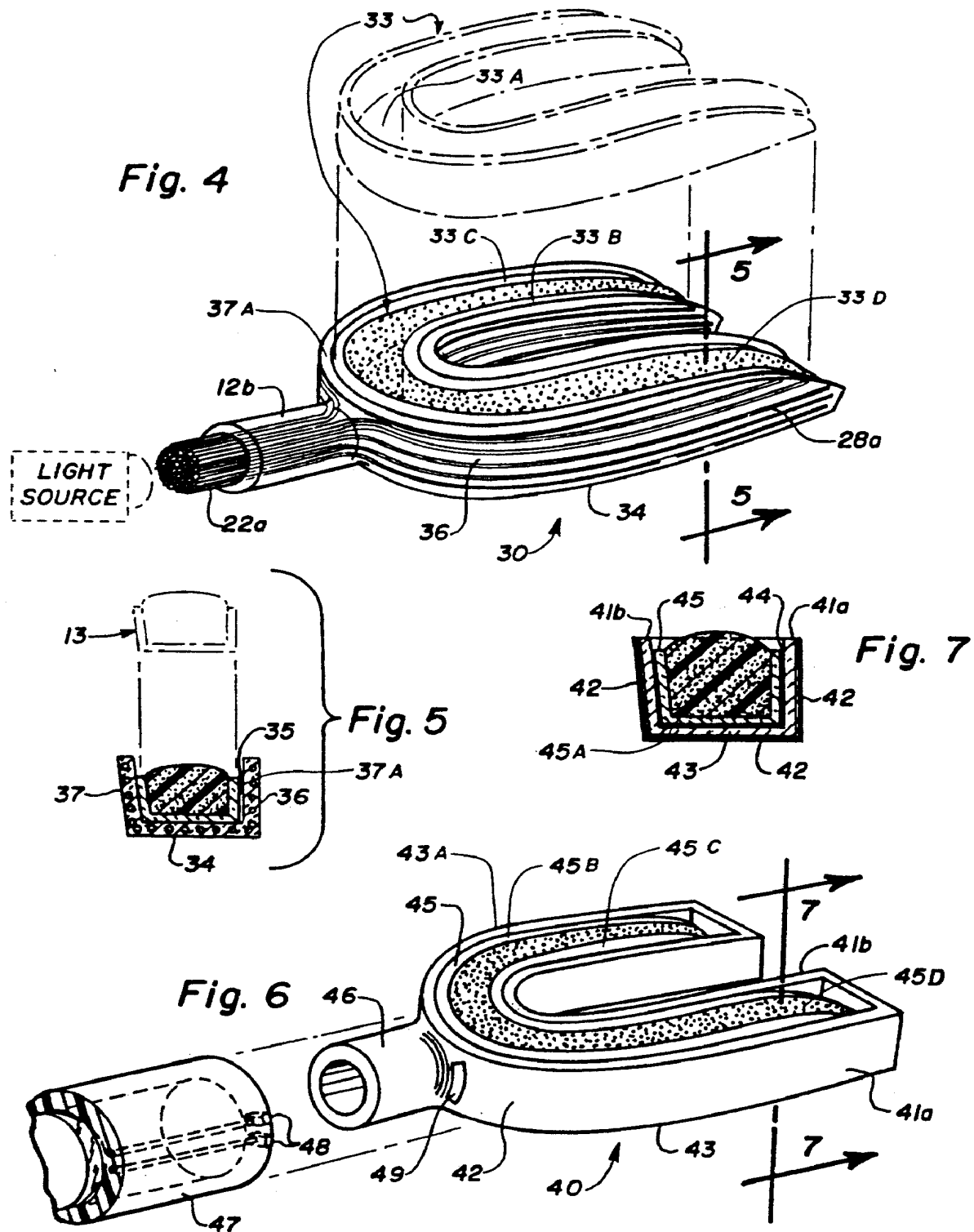
[57] ABSTRACT

A light-curing apparatus for curing polymerizable material in the mouth is provided. In one embodiment the apparatus comprises a wand which is substantially the same size as a quadrant or a full dental arch; in a second embodiment, the apparatus is in the shape of a dental tray and is adapted to fit over the outside of a dental tray; and in a third embodiment the light source comprises a portion (substantially the frame) of a double arch impression tray, and has a slide mechanism by which the mesh of a double arch impression tray can be removed from the light source so the light source can be reused. The invention also comprises a method for curing a dental material in the mouth using the apparatus of the invention.

48 Claims, 3 Drawing Sheets







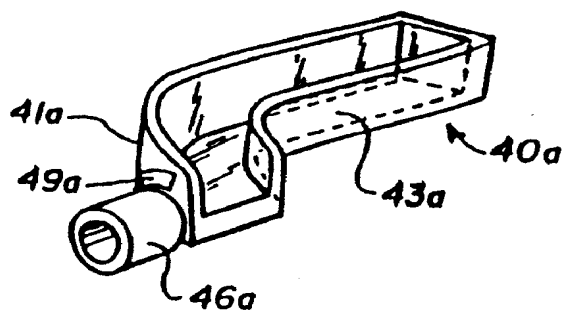


Fig. 8

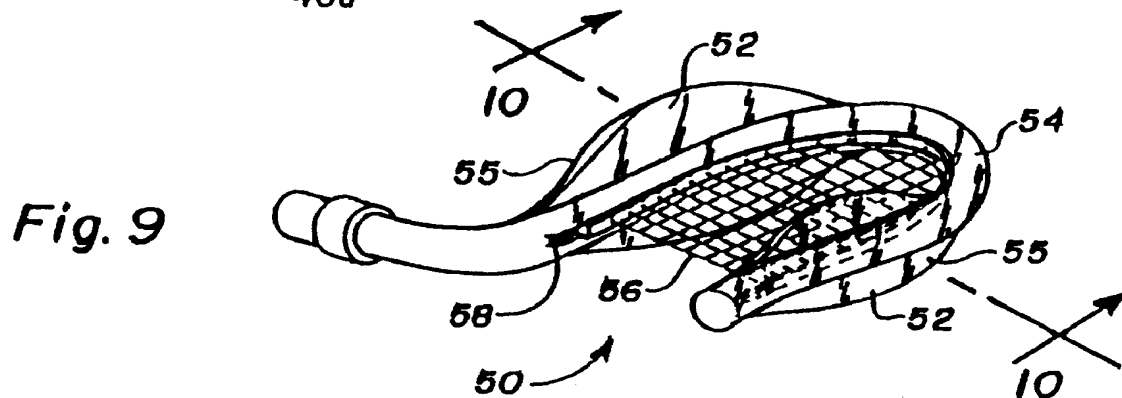


Fig. 9

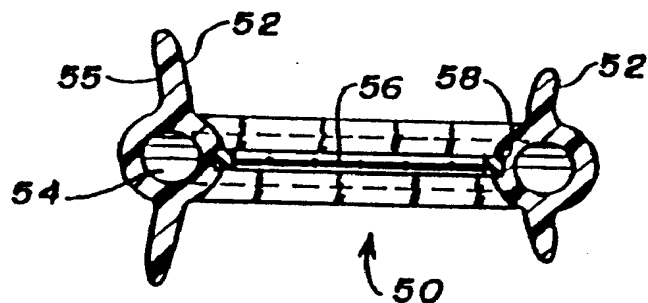


Fig. 10

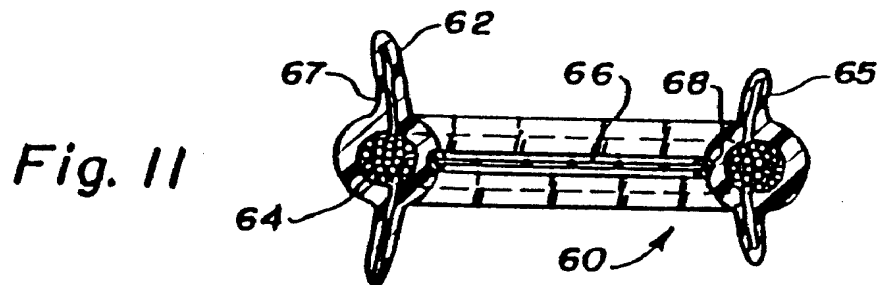


Fig. 11

LIGHT CURING APPARATUS AND METHOD

BACKGROUND

This is a continuation-in-part of U.S. patent application Ser. No. 07/609,036 filed Nov. 5, 1990, now abandoned, which is a continuation of U.S. patent application Ser. No. 07/208,201 filed Jun. 17, 1988, now abandoned.

The present invention relates to light curing of dental impression material, in particular the invention provides a light apparatus adapted for fitting over an impression tray and a method for curing a light polymerizable impression material while the impression material is in contact with an area of which an impression is desired. Beneficially, the invention provides simultaneous substantially even distribution of light over light curable dental impression material while such material is in contact with teeth.

Wang in U.S. Pat. No. 4,553,936, Johnson in U.S. Pat. No. 4,445,858 and Hammesfahr et al in U.S. Pat. No. 4,867,682 disclose apparatus which provide light from only one location at a particular time. Thus, these apparatus are not adapted to provide simultaneous substantially even distribution of light over a U-shaped arch of light curable dental impression material while such material is in contact with teeth as is provided by the present invention.

The use of visible light cured polymeric impression materials such as those disclosed in U.S. Pat. No. 4,813,875 and U.S. patent application Ser. No. 120,269 filed Nov. 13, 1987, both incorporated herein by reference, are gaining acceptance as a desirable means of obtaining a dental impression. Such polymeric materials can be adapted to be dispensed from a syringe or used with an impression tray. Such a visible light cured polymeric impression material is sold under the trademark GENESIS™ by Dentsply International Inc.

It is desirable in many uses to provide the impression material in a disposable tray, and to provide a light source in a more permanently reusable form. Whether the impression material is preloaded in the impression tray in the factory according to U.S. patent application Ser. No. 032,903 filed Mar. 31, 1987, and U.S. patent application Ser. No. 120,304 filed Nov. 13, 1987, assigned to Dentsply International Inc., incorporated herein by reference, or loaded by the practitioner immediately before use, a key to the convenience and usability of such a material is a rapid cure to a strong and elastomeric material when actinic light is applied to the material at the convenience of the practitioner. In the past, such actinic light was provided as a point source, such as is the conventional adaptation of a PRISMETICS® LITE apparatus, available from The L. D. Caulk Company, a division of Dentsply International Inc. The point source in the PRISMETICS® LITE apparatus is a light-issuing tip having a diameter of less than about 1.5 cm. When a point light source can be used, the practitioner must move the point source from point to point over the impression tray to cure all the material in the tray. Although it may take only 10-20 seconds at a particular point to cure that portion of the impression material sufficiently, in a typical full dental arch tray, which has hard-to-reach areas and a surface area of about 60 cm², it may take as much as 2-5 minutes, or more, to cure all the impression material in the tray. Also, in some circumstances, it is desirable to cure the impression material evenly over the whole surface

rather than cure one side of the tray, and then the other side of the tray in sequence.

In prior art point source devices, used alternately to cure small fillings in the mouth, the intensity of the light source is limited by its possible effect on the retina of the human eye. Sources with intensity greater than about 1 w/cm² may be hazardous and accordingly fall outside the Commercial National Standard draft specifications and ADA Standards for such devices.

It is an object of the present invention to provide an apparatus and a method to rapidly cure impression material while making a dental impression.

It is a further object of the present invention to provide an apparatus and a method simultaneously and uniformly cure all of the impression material in a dental tray while making a dental impression.

It is another object of the invention to increase substantially, uniformity of emission of light issuing from a high intensity source to be substantially evenly distributed over at least a large portion of a U-shaped dental arch without necessarily increasing the overall (average) intensity of the light per unit area.

SUMMARY OF THE INVENTION

The present invention relates to a visible wavelength light source comprising an element having a generally curved shape and having a size adapted to fit into a mouth. The element has means for transmitting light from substantially every portion of the element onto a material which is to be light polymerized in the mouth. In a preferred embodiment, the light source is in U-shape in the form of a dental arch or a portion of a dental arch. In one embodiment, the element comprises a plane wherein the light transmitted is transmitted from a single plane which is adapted to be parallel to the alveolar ridge.

In a preferred embodiment of the invention, the element comprises a trough, having a bottom and sidewalls, which is adapted to fit over the outside of an impression tray and to transmit light through the bottom and sidewalls of the trough at substantially normal angles into the impression tray.

Light may be transmitted through fiber optics or by including a light-emitting device or devices such as a tungsten/halogen vacuum bulb, light emitting diodes or the like, within the element in the shape of the element. Light may also be transmitted using mirroring of the sides and bottom of the trough. Mirroring may also be used advantageously in combination with other light transmitting or emitting sources such as those given by way of example above.

In a preferred embodiment of the invention the light source comprises a frame for double arch impression tray. In such an embodiment, in its most preferred form, a mesh contains impression material on both sides for taking the impression of the upper and lower arches of teeth or portions of the upper and lower arches. The mesh is desirably carried by a frame when positioned in the mouth and after the impression is taken the mesh is removed from the frame. The frame provides a light source and when the mesh is removed a new mesh may be inserted and the frame reused. In such an embodiment the frame may contain a light bulb contoured in the shape of the frame, or fiber optic bundles may comprise the shape of the frame wherein, for example, fiber optic ends from the bundle may be evenly distributed throughout the surface of the frame. As in the above-

described embodiments, the outside surface, the wings in the case of double arch impression tray frame, may be mirrored to optimize the utilization of the light.

A method of polymerizing a light polymerizable material in an impression tray is provided in accordance with the invention. The method uses a U-shaped light source in conjunction with an impression tray. By placing the light source in close proximity to the impression tray, and transmitting light from the light source to the impression material it is polymerized in the impression tray.

The apparatus and method of the invention make it possible to cure all of the impression material in an impression tray substantially at the same time, and to reduce the amount of time and difficulty required to cure the impression material.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an element of the invention containing a light proximal to an impression tray.

FIG. 2 is a plan view of an alternative light-containing element of the invention.

FIG. 3 is a perspective view of an element of the invention containing optic fibers.

FIG. 4 illustrates a loaded impression tray seated inside an element containing optic fibers.

FIG. 5 is a sectional view taken on line 5—5 of FIG. 4.

FIG. 6 illustrates a loaded impression tray seated inside an element which has a mirrored surface.

FIG. 7 is a section taken on line 7—7 of FIG. 6 showing the outside mirrored surface.

FIG. 8 is a perspective view of an element of the invention in the shape of a partial dental arch.

FIG. 9 is a top view of a double arch impression tray containing a light source means.

FIG. 10 is a sectional view taken on line 10—10 of FIG. 9.

FIG. 11 is a top view of a double arch impression tray containing light-transmitting optical fibers.

DETAILED DESCRIPTION OF THE INVENTION

Dental arch shaped light distributors in accordance with the invention all adapted to provide substantially uniform light intensity over substantially the entire lower and side surfaces of light curable dental impression material while positioned in a patient's mouth. Substantially uniform distribution of light intensity is accomplished by providing uniform distribution along the length of each side of a dental arch, light emission means which emit substantially equal light intensity such as light sources and/or optical fiber ends from which light is emitted.

In a U-shaped light distributor in accordance with the invention light is emitted uniformly from a plurality of light emission means uniformly positioned along each of the sides. Each of the two sides of the U-shaped light distributor is a mirror image of the other side. Thus, light of substantially equal intensity is emitted from each of a plurality of uniformly distributed points on both sides of the U-shaped distributor and at all such points is emitted immediately adjacent to light curable dental impression material. This simultaneous uniform emission of light simultaneously uniformly cures the entire U-shaped light curable dental impression material positioned adjacent to the U-shaped light distributor.

Referring to FIG. 1, a light element (wand) 10 and tray 11 are seen. Tray 11 has a U-shaped bottom wall 11A integrally connected to inner and outer U-shaped side walls 11B and 11C respectively. Outer side wall 11C is connected to tab 11D. Light element 10 has a stem 12 and two side arches 14 which are joined to form a U-shaped full dental arch containing a light bulb 16. Stem 12 provides means for the practitioner to hold the apparatus when it is used and means for containing the wires that supply electricity to light bulb 16. It is desirable that light bulb 16 be conformed to the U-shape of said full dental arch and be completely sealed within element 10 when in use, and that top 26, bottom 17, sides 19 and end plate 18 completely encase bulb 16. Light element 10 is shown in close proximity to impression tray 11 in a position similar to that which will be used to cause curing of the impression material in the tray.

Those skilled in the art will recognize that means may be provided to open element 10 to replace bulb 16. For example, top 26 may have a snap fit connection to bottom 17 throughout side 19.

While element 10 is designed primarily to provide actinic light through bulb 16, those skilled in the art will recognize that bottom 17 and sides 19 of element 10 are preferably mirrored to enhance the effect of the light emitted through top 26 from light 16. Of course in another alternate form, the bottom 17 could also be planar for special uses. Bulb 16 may comprise a filament containing bulb and/or a gas containing bulb wherein the gas contained therein is activated to generate light (for example, a fluorescent light).

An alternative element embodiment is illustrated in FIG. 2. Element 10a includes a series of light sources 15. Light sources 15 may be a series of light bulbs or a series of light emitting diodes.

In the illustrated embodiment of FIGS. 1 and 2, top 26 of element 10 is a substantially planar surface throughout the dental arch shape of the apparatus. In its use, the apparatus is held next to a dental tray after the dental tray has been positioned to take a dental impression of an upper or lower arch. The light bulb 16, which preferably produces light in the visible wavelength range, preferably a wavelength of 360–600 nm, is then turned on for a time sufficient to cure the dental impression material. Those skilled in the art will recognize that the apparatus may be provided in the shape of a partial dental arch, such as that illustrated in FIG. 8 for a different embodiment.

Referring now to FIG. 3, a fiber optic element 20 of the invention is illustrated comprising a stem 12a and an optic fiber bundle 22 contained within stem 12a. Optic fibers 28 extend from bundle 22 and are distributed substantially evenly in top 26a where optic ends 24 attach to top 26a. It is desirable that ends 24 be connected substantially perpendicular or normal to the tray surface so that maximum penetration of light into the impression material is achieved. Element 20 is structured similar to element 10 having bottom 17a, end 18a and sides 19a with top 26a providing a substantially planar surface.

Element 20 is in one preferred use used substantially in the same manner as element 10, transmitting light substantially from a plane conforming to or comprising the curved U-shape of the dental arch or portion of a dental arch. In both cases, if desired, the practitioner may supplement the light transmitted from the element with another light apparatus (such as Prismetics®).

light) along the sides of the impression tray after, before or simultaneous with the application of light from element 10 or element 20. Bottom 17a, sides 19a and end 18a may be mirrored to enhance the effects of the transmitted light. The element may also be provided in the shape of a partial dental arch as is illustrated in FIG. 8 for a different embodiment.

Referring now to FIGS. 4 and 5, tray-shaped fiber optic element 30 comprises a stem 12b containing a fiber optic bundle 22a; and, bottom 34, and sides 36 and 37 which together form housing 37A and enclosed trough 35 in the shape of a dental arch. The sides 36 and 37 of element 30 are dimensioned so that they fit over the outside of light transparent dental tray 33 which is illustrated within element 30 and above element 30 in phantom lines. Tray 33 has a U-shaped bottom wall 33A integrally connected to inner and outer U-shaped side walls 33B and 33C respectively. Tray 33 supports photopolymerizable impression material 33D. Tray 37A is adapted to be positioned within trough 35 of housing 37A. Optic fibers 28a from bundle 22a are directed to and are embedded in bottom 34, sides 36 and 37 in a substantially even distribution to provide actinic light over substantially the whole surface area of trough 35. In the illustrated embodiment, optic fibers 28a are an unclad acrylic type, glass type or a similar type of optic fiber, that transmits light through the wall of the fiber. Those skilled in the art will recognize that clad optic fibers, which transmit light substantially end to end of the fiber may be used in the embodiment of FIG. 4. In such a case, the ends of the optic fibers will be attached to the element in a manner similar to that illustrated in FIG. 3. Sides 36 and 37 and bottom 34 preferably have mirrored surfaces to enhance the effect of the light transmitted into trough 35, and the element may be provided in the general shape of a partial dental arch (quadrant) as is illustrated by element 40a in FIG. 8.

In its use, after an impression tray filled with impression material is positioned on the area of which an impression is desired, element 30 is placed over the impression tray with the sides 36 and 37 encompassing the sides of the impression tray and bottom 34 adjacent to the bottom surface of the impression tray. Actinic light is then passed through the impression tray for a time sufficient to polymerize the impression material.

In another embodiment, using high intensity light, an element having only mirrored surfaces, as illustrated by element 40 in FIGS. 6 and 7 may be used.

Referring now to FIGS. 6 and 7, element 40 comprises outside side surface 41a in the shape of a dental arch having mirrored surface 42 and mirrored inside sides 41b also in the shape of a dental arch, sides 41a and 41b being connected to bottom wall 43 forming housing 43A and enclosing trough 44 therebetween. It will be understood that as shown the mirrored surface 42 covers walls 41a, 41b and 43. In the illustrated embodiment, sides 41a, 41b and joining wall 43 are dimensioned to permit seating of impression tray 45 within trough 44. Tray 45 has a U-shaped bottom wall 45A integrally connected to inner and outer U-shaped side walls 45B and 45C respectively. Tray 45 supports photopolymerizable dental impression material 45D. Tray 45 is adapted to be positioned within trough 44 of housing 43A. Stem 46 is adapted to receive a light source 47 having a very high intensity. Because of the high intensity of light source 47, as a safety feature, light source 47 has terminal 48 which completes an electrical circuit when they contact plate 49 on element 40. Accordingly,

light source 47 cannot be activated unless connected to element 40.

FIG. 8 is an illustration of a quadrant light element 40a which is constructed in the same manner as full arch element 40 of FIG. 6. Stem 46a, mirrored sides 41a and 43a, and plate 49a have the same function as similar parts illustrated in FIG. 6.

Referring now to FIGS. 9 and 10, an impression tray known as a double arch impression tray is illustrated. A double arch impression tray is used to obtain an impression of upper teeth and lower teeth while at the same time establishing the bite relationship between the upper and lower teeth (i.e. a triple function). Double arch impression tray light source 50 comprises wing 52 on each side thereof which is made of a flexible material, such as a flexible plastic, which conforms to the shape and size of the patient's mouth; mesh 56 which holds impression material on its upper and lower surfaces; and in the illustrated embodiment, light bulb 54 which is formed in the shape of the double arch impression tray and comprises a substantial part of its frame; and slide 58 which permits separation of mesh 56 from light source 50 so that light source 50 can be reused simply by inserting a new mesh 56 into slide 58 when a new impression is desired. Wings 52 may desirably have a mirrored outside surface 55 which increases the efficiency of the light source.

When used, the tray is put in position for taking an impression, and light in the visible spectrum is preferably applied using parameters described below for a period of time calculated as described below.

The tray may be sterilized, as is the case with each of the embodiments described herein, by well-known techniques of cold sterilization or by other means known to those skilled in the art.

In an alternative embodiment of a double arch impression tray light source 60 as illustrated in FIG. 11, instead of using a light bulb, light may be transmitted into the tray by optic fibers 67 which are attached to the tray through fiber optic bundle 64 which provides a frame for double arch impression tray 60. Optic fibers 67 are attached to wings 62 in a substantially even distribution, and in the preferred embodiment, wings 62 will have outside mirrored surfaces 65 which reflect actinic light into impression material contained on mesh 66. Slide 68 permits the separation of mesh 66 from light source 60 when an impression is completed, and permits the reuse of light source 60 for taking additional impressions.

Those skilled in the art will recognize that optic fibers may be provided which substantially contain light within the fiber to be delivered from the end thereof (e.g. clad optic fibers), or may be provided in a form where light is delivered through the walls of the fiber (e.g. unclad optic fibers). As described herein, clad glass type optic fibers are preferred for use in light sources 20, and unclad acrylic type light fibers are preferred in light sources 30, 50 and 60.

In the embodiments where light is piped into a tray from an outside point source, such as the mirrored light source such as light source 40, or the fiber optic light sources such as light sources 20, 30, 50 and 60, means may be provided, similar to that illustrated for element 40 to prevent activation of a point source light (which can be connected to the fiber optic bundle, for example) unless a connection is made between the point light source and the fiber optic bundle. This may be provided as a safety feature so that the operator and the patient

will not be exposed to potentially harmful high light intensity from the point source.

Materials used to make the light sources described herein may comprise materials known in the art for making dental impression trays. Also, although illustrated as being made of a substantially rigid material, those skilled in the art will recognize that many of the embodiments described herein (especially elements containing optic fibers) may be made of a substantially flexible material that permits the light element or source to conform substantially to the shape of an impression tray, or may comprise a fiber optic mat with a minimal, or no plastic coating.

Using the apparatus of the invention, it is theoretically possible to cure dental impressions and the like to a clinically acceptable state in less than 60 seconds, preferably less than 30 seconds, and more preferably less than 10 seconds and even more preferably 5 seconds or less and most preferably less than 1 second.

For safety it is preferred that the light intensity transmitted or emitted from the surface of a light source element be no more than about 1 watt per square centimeter (w/cm^2), and preferably the intensity will be about $0.5 \text{ w}/\text{cm}^2$ and most preferably about $0.25 \text{ w}/\text{cm}^2$. Also to provide superior safety the light should be substantially limited to the visible light spectrum of 360–600 nm. The present invention has especial utility with a light transmitting area about 5 to 80 cm^2 , preferably about 5 to 60 cm^2 .

EXAMPLE

A light curing elastomeric impression material described in copending U.S. patent application Ser. No. 120,269 filed Nov. 13, 1987, is marketed together with suitable impression trays and other accessories under the trademark "GENESIS™" by The L.D. Caulk Company Division of Dentsply International Inc. The impression material is placed into a clear impression tray and cured by moving a point source over the surface of the tray to obtain a satisfactorily cured dental impression. The point source recommended is a PRISMETICS® lamp with an output of about 500 milliwatts per square centimeter (mw/cm^2) in the visible spectrum, between 360 and 600 nm wavelength. The PRISMETICS® light has an issuing tip having an area of about 0.8 cm^2 . When a quadrant tray, such as would mate with the quadrant light of FIG. 8, is used to contain the impression material, it presents a tray surface area in contact with a like outwardly exposed surface area of dental impression material of surface of about 30 cm^2 . The material is considered properly cured after about 100 seconds of irradiation. The effective curing power required is then about $500 \text{ mw}/\text{cm}^2 \times 0.8 \text{ cm}^2 \times 100 \text{ sec} = 40000 \text{ mw sec}$. (where mw represents milliwatts) = 40 w sec . for the entire quadrant tray, or $1.33 \text{ w sec}/\text{cm}^2$.

THEORETICAL APPLICATION

Using the curing index for the GENESIS™ impression material ($1.33 \text{ w-sec}/\text{cm}^2$), theoretically one can establish the total power (mw sec.) needed for curing trays of the same general construction containing the same polymer having larger surface areas, such as a full tray. From this can be calculated the time needed for curing dental impressions using any light sources of known transmissional area and having a known power rating using the formula

$$\frac{A' \times A \times 1.33 \text{ w sec}/\text{cm}^2}{P} = \text{number of seconds for cure}$$

wherein A is the surface area of the light element in cm^2 and P is the intensity of the light source in watts when a 1 cm^2 point light source is used. A' is a ratio, adjusting for the size of the point light source, obtained by dividing the actual area of the point source in cm^2 by 1 cm^2 .

Of course, for each dental impression material and tray the initial calculation will be different and those skilled in the art will recognize that the "curing index" for other curable materials can be established in the same way as described above, and that the above formula can be modified to take into account the efficiency and the light transmitting ability of a particular light source or the efficiency of a particular tray material and impression material to permit light to pass there-through.

Thus light-curing power of from 5–200 w-seconds, in the specific example provided, more preferably from 20–80 w-seconds is required to polymerize adequately the material in a quadrant tray by moving a point source over the exterior surface.

If one were to increase the intensity of the point source light to $5 \text{ w}/\text{cm}^2$ a lesser time, for example, only about 10 seconds of irradiation, would be required to cure all the material in the tray. Theoretically, in order to reduce the amount of time required to achieve the same extent of cure to 1 second, the output of the point source light would be about $50 \text{ w}/\text{cm}^2$. This light requirement is a function of the specific impression composition, the monomers and/or prepolymers used, and their initiators and coinitiators and the size of the specific tray.

In a tray where a point source is attached to the light wand, and the light wand distributes the light delivered, a point source, in a 30 cm^2 quadrant light wands having an intensity of about $4 \text{ w}/\text{cm}^2$ will be needed to effect a cure in about 10–12 seconds.

As described in the present invention, the whole exposed surface of the dental material can be irradiated simultaneously and substantially uniformly to provide a cured object, without the necessity of moving a point source light over the surface. Rather, an impression is placed and then illuminated by means of a light curing wand of the invention. Although the intensity of light applied to each square centimeter of the impression material may be about the same as that of the light conventionally applied by a point light source, this intensity is achieved over the entire surface at substantially the same instant. For example, if an impression tray with a surface area of 30 cm^2 is cured adequately with a point source 0.8 cm^2 and an intensity of about $0.5 \text{ w}/\text{cm}^2$ in 100 seconds, a wand or light device of the invention having an area of 30 cm^2 delivering an output intensity of $0.5 \text{ w}/\text{cm}^2$ theoretically would cure the material in about 2.7 seconds. A similar light wand delivering $0.1 \text{ w}/\text{cm}^2$ would cure the impression in 13 seconds; or if $1.0 \text{ w}/\text{cm}^2$ were delivered, the impression could be cured in 1.3 seconds.

Impression trays having an impression material engaging surface area of from about 5 cm^2 to about 80 cm^2 are common in the art. To cure the impression material in such trays in a range of 0.1 to 80 seconds, the present invention may theoretically utilize point light

sources having intensities of about 0.5–140 w/cm², preferably about 1–90 w/cm², and most preferably about 2–70 w/cm².

In the case where higher powered lamps are used to illuminate the surface uniformly, the impression material can be cured in shorter time. Shortened residence times are more comfortable to the patient and can reduce labor costs and chair time for the dentist. In the case that times can be reduced to about 1–60 seconds, more preferably 1–30 seconds, and even more preferably 1–10 seconds there is substantially no need to physically maintain the tray in place over a long period of time as is the case with longer cure times to preserve the relationship between the impression material and the dental structure of which an impression is being taken.

While being described primarily as an apparatus and method for taking a dental impression, those skilled in the art will recognize that the same procedures can be used for curing dental materials used to reline dentures or materials associated with orthodontic appliances and other dental materials known to those skilled in the art.

Those skilled in the art will recognize that the intensity of the light source can be adjusted to deliver the intensity of light desired to the impression material depending on the efficiency of the light transmitting means, the size of the element and the curing efficiency of the material.

While the invention has been illustrated and described, it will be recognized by those skilled in the art that this invention may be otherwise variously embodied and practiced without departing from the scope of the following claims.

What is claimed is:

1. A visible wavelength light source for polymerizing light curable dental material within the mouth, comprising:

(a) an element adapted to support light curable dental material in the mouth and

(b) means for generating light in said element, said element having a U-shape length and a size conforming substantially to the configuration of a dental arch, said element having a U-shaped bottom wall, integrally connected to inner and outer U-shaped side walls, said element having a light emitting surface area of at least about 5 cm², and said means for generating light being integrally connected to said element said means for generating having a light source selected from the group consisting of an optical fiber and a bulb having a filament, said light source being supported by and substantially evenly distributed along said length of said element, and being adapted to transmit light substantially uniformly onto said dental material.

2. The visible light source of claim 1 in which the light source is adapted to transmit light through an impression tray to cure a polymerizable material contained therein.

3. The light source of claim 1 which comprises a planar surface adapted to be oriented toward a dental arch in the mouth and wherein light transmitted from said element is emitted substantially from said planar surface.

4. The light source of claim 3 in which said means for transmitting light comprises optic fibers.

5. The light source of claim 1 in which said element comprises a bottom and sidewalls attached to said bottom on both sides thereof to form a trough, said element being adapted to fit over the outside of a light-transmitting impression tray, wherein said element is adapted to

transmit light through a bottom and sidewalls of said impression tray, at substantially normal angles to said bottom and sidewalls of said impression tray.

6. The light source of claim 5 in which said means for transmitting light comprises optic fibers.

7. The light source of claim 5 in which said means for transmitting light comprises mirrored surfaces in said trough.

8. The light source of claim 1 in which said means for generating light comprises means chosen from the group consisting of a vacuum bulb, a number of light emitting devices distributed substantially evenly with regard to a light transmitting area of said light source, or a combination thereof.

9. The light source of claim 1 in which said means for generating light produces a generated light having an intensity of less than about 1 w/cm², said generated light being limited substantially to the wavelengths of about 360–600 nm and comprises a light transmitting area of at least about 10 cm².

10. A method of polymerizing a light polymerizable dental material in the shape of a dental arch while said dental material is in contact with structure in the mouth and providing an outwardly exposed surface, comprising: the steps of sequentially

(a) providing a light source means for generating light having a U-shape of a dental arch, said shape comprising a plane and light transmitted from said light source being emitted substantially from said plane, said light source comprising a vacuum bulb having the general shape of said plane,

(b) placing said dental material in a desired position in a mouth,

(c) placing said light source next to said dental material, and

(d) transmitting light from said light source substantially, uniformly over at least a substantial portion of an outwardly exposed surface of said dental material to polymerize said material.

11. The method of claim 10 wherein the dental material is dental impression material, reline material or orthodontic appliance material.

12. The method of claim 10 in which said element has a bottom and sidewalls attached to said bottom on both sides thereof to form a trough adapted to fit over the outside of an impression tray, and said light source is adapted to transmit light through said bottom and said sidewalls, at substantially normal angles to said bottom and said sidewalls into said trough.

13. The method of claim 12 in which said means for transmitting light comprises optic fibers.

14. The method of claim 12 in which said means for transmitting light comprises mirrored surfaces in said trough.

15. The method of claim 10 in which said means for transmitting light comprises optic fibers.

16. The method of claim 10 wherein the dental material is polymerized in about 1 minute or less and said light source is operated at an intensity of less than about 1 w/cm².

17. The method of claim 10 wherein said light source comprises a series of light emitting devices distributed substantially uniformly over its surface.

18. A method of polymerizing a light polymerizable dental material in the shape of a dental arch while said dental material is in contact with structure in the mouth and providing an outwardly exposed surface, comprising: the steps of sequentially

- (a) providing a light source means for generating light having a U-shape dental arch shape,
- (b) placing said dental material in a desired position in a mouth,
- (c) placing said light source next to said dental material, and
- (d) transmitting light from said light source substantially, uniformly over at least a substantial portion of an outward surface of said dental material to polymerize said dental material being polymerized in less than about 5 seconds and said light source being operated at an intensity of less than about 0.5 w/cm², having a light transmitting area of at least about 10 cm² and emitting light limited substantially to the wave bands of about 360-600 nm.

19. A visible wavelength light source for polymerizing light curable dental material in the mouth, comprising:

- (a) an element having a shape and size conforming substantially to a U-shaped configuration of a dental arch,
- (b) means for generating light, said means for generating light having at least one filament within a gas containing bulb, said bulb being supported by and positioned within said element, said means for generating light having means to be connected to supply electricity to said bulb, and
- (c) a light transmitting means having a U-shaped bottom member and two side members connected to said bottom member and adapted to be removably connected to said element, said light transmitting means being adapted to hold said dental material in proximity to said element.

20. The light source of claim 19 wherein said light transmitting means comprises an optical fiber web to which dental material may be applied on both sides thereof, and wherein said optical fibers of said web area adapted to emit light from the surfaces thereof to cure said dental material in contact with said optical fiber web.

21. A method of polymerizing a light polymerizable U-shaped dental material while said dental material is in contact with structure in the mouth, comprising: the steps of sequentially

- (a) providing a light source adapted to correspond in general to a U-shape,
- (b) placing said dental material in a desired position in a mouth,
- (c) placing said light source next to said dental material, and
- (d) transmitting light from said light source substantially uniformly over at least a substantial portion of an outwardly exposed surface of said dental material to polymerize said material,

wherein said light is transmitted from said light source in said U-shape and wherein said light source comprises a vacuum bulb having a U-shape.

22. A method of polymerizing a light polymerizable dental material in the shape of a dental arch while said dental material is in contact with structure in the mouth, comprising: the steps of sequentially

- (a) providing a light source means for generating light and having a U-shape,
- (b) placing said dental material in a desired position in a mouth,
- (c) placing said light source next to said dental material, and

- (d) transmitting light from said light source substantially uniformly over at least a substantial portion of an outwardly exposed surface of said dental material,

wherein said light is transmitted from said light source and wherein said light source is selected from the group consisting of a series of light emitting devices and light transmitting optic fibers distributed so as to transmit light substantially uniformly from a surface of said light source.

23. A visible wavelength light source for polymerizing light curable dental material in the mouth, comprising:

- (a) an element having a shape and size conforming substantially to a U-shaped configuration of a dental arch,
- (b) optic fiber means adapted for emitting or transmitting light, said optic fiber means having the shape of a dental arch and being contained within said element, and
- (c) a removable light transmitting means having a bottom member and two side members connected to said bottom member and adapted to be removably connected to said element, said light transmitting means having a shape and size conforming substantially to a U-shaped configuration of a dental arch said light transmitting means being adapted to hold said dental material in proximity to said element.

24. A method of polymerizing method for a light polymerizable dental material while said dental material is in contact with structure in the mouth, comprising the steps of:

- (a) providing a light source means for generating light having a U-shape and sized to fit in a mouth in alignment with at least a portion of a dental arch, said light source being adapted to transmit light and said light source comprises a vacuum bulb having a dental arch U-shape and
- (b) providing means for transmitting light from said light source substantially uniformly over at least a substantial portion of an outwardly exposed surface of said dental material to polymerize said material and
- (c) polymerizing said material.

25. A dental light for polymerizing a light polymerizable dental material while said dental material is in contact with structure in the mouth, comprising:

- (a) a light source having a dental arch U-shape and sized to fit in a mouth in alignment with at least a portion of a dental arch, said light source transmitting light in said arch shape and said light source being selected from the group consisting of a series of light emitting devices and light transmitting optic fibers distributed so as to transmit light substantially uniformly from a surface of said light source and
- (b) means for transmitting light from said light source substantially uniformly over an outwardly exposed surface of said dental material to polymerize said material
- (c) a tray for supporting said material, said tray having a U-shaped bottom wall integrally connected to inner and outer U-shaped side walls.

26. A method for polymerizing light curable dental material in the mouth, comprising the steps of: providing a light source transmitting visible wave-length light and having a shape and size conforming substantially to

a configuration of a U-shaped dental arch and sized to fit in the mouth, said light source comprising an unclad optic fiber having a fiber wall which transmits light along its length and delivers light from said fiber wall along its length for polymerizing said light curable dental material in the mouth and polymerizing said material in the mouth.

27. The method of claim 26 wherein said unclad optic fiber is exposed for direct contact with the polymerizing light curable dental material in the mouth.

28. A method of polymerizing a light polymerizable dental material in the U-shape of a dental arch while said dental material is in contact with structure in the mouth, comprising: the steps of sequentially

- (a) providing a light source comprising a vacuum bulb and having a general U-shape in a plane and emitting light substantially from said plane,
- (b) placing said dental material in a desired position in the mouth,
- (c) placing said light source next to said dental material, and
- (d) transmitting light from said light source substantially, uniformly over at least a substantial portion of an outwardly exposed surface of said dental material to polymerize said material.

29. A method of polymerizing a light polymerizable dental material in the U-shape of a dental arch while said dental material is in contact with structure in the mouth comprising the steps of sequentially

- (a) providing an element and a housing having a light source, said element comprising a U-shaped tray said housing having U-shaped bottom and inner and outer side walls connected to form a trough adapted to support light curable material, said tray being adapted to be positioned within said trough, said light source comprising a series of light emitting devices adapted to distribute light substantially uniformly over an adjacent surface of said light curable material,
- (b) placing said light source next to said dental material, and
- (d) transmitting light from said light source substantially, uniformly over at least a substantial portion of an outwardly exposed surface of said dental material to polymerize said material.

30. A visible wavelength light source for polymerizing light curable dental material in the mouth, comprising: an element having a bottom member and side members and a shape and size conforming substantially to a U-shaped configuration of a dental arch,

- (a) means for generating light in said element having optical fibers position in a U-shape and adapted to distribute light along at least the majority of said dental arch, and
- (b) a light transmitting means having a bottom member and two side members connected to said bottom member, adapted to be removably connected to said element, said light transmitting means being adapted to be supported by said bottom and side members of said element, and to hold said dental material in proximity to said element.

31. A method of polymerizing a light polymerizable elastomeric dental impression material in the U-shape of a dental arch while said dental material is in contact with structure in the mouth, comprising: the steps of sequentially

- (a) providing an element and a housing,

said element comprising a U-shaped tray and a housing

said housing having U-shaped bottom and inner and outer side walls connected to form a trough adapted to support light curable material, said tray being adapted to be positioned within said trough, said housing having a web formed from a plurality of optic fibers having unclad portions and corresponding in general configuration to at least a substantial portion of a dental arch shape,

- (b) placing a dental impression material directly over the unclad optic fiber portions of said web,
- (c) placing said web with said dental impression material thereon in a mouth and forming a dental impression,
- (d) transmitting light from said unclad portions of said optic fiber web and polymerizing the light polymerizable dental impression material and forming an elastomeric dental impression.

32. A dental light for polymerizing light curable dental material in the mouth, comprising: a light source transmitting visible wavelength light and having a shape and size conforming substantially to a dental arch and sized to fit in the mouth, said light source comprising a plurality of at least partially unclad optic fibers formed into a web, each of said unclad optic fibers having a fiber wall adapted to transmit light along at least a portion of its length and to deliver said light from a sufficient portion of the length of said wall where it is unclad into adjacent light curable dental material for substantially polymerizing said light curable dental material in a tray, said tray having a U-shaped bottom wall integrally connected to inner and outer U-shaped side walls.

33. The dental light of claim 32 wherein each of said unclad optic fibers is exposed for direct contact with the polymerizing light curable dental material in the mouth.

34. A method of polymerizing a light polymerizable elastomeric dental impression material in the shape of a U-shaped dental arch while said dental impression material is in contact with structure in the mouth, comprising: the steps of sequentially

- (a) providing a light source means for generating light having a U-shape adapted to distribute light from a curved side portion of a dental arch U-shape,
- (b) placing a dental impression material in a desired position in a mouth,
- (c) placing said light source in said mouth next to said dental impression material, and
- (d) emitting and transmitting light from said light source substantially uniformly directly over at least a substantial portion of an outwardly exposed surface of said dental impression material along a substantial portion of a dental arch U-shape to polymerize said material and form an elastomeric dental impression.

35. A dental light for polymerizing a light polymerizable elastomeric dental impression material while said dental impression material is in contact with structure in the mouth, comprising:

- (a) a light source being adapted to distribute light from and to be supported by a U-shaped dental arch and curved to conform with such substantial portion of said dental arch and sized to fit in a mouth in alignment with at least a portion of said dental arch, said light source transmitting light in said general configuration of said dental arch and

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said light source comprising light emitting and light transmitting sources selected from the group consisting of a series of light emitting devices and a plurality of light transmitting optic fibers and said light emitting and transmitting sources being positioned to emit and transmit light substantially uniformly over at least a substantial portion of an outwardly exposed surface of dental impression material in a tray placed in position for taking a dental impression in the mouth and sufficient to polymerize the dental impression material and form an elastomeric dental impression and a tray said tray having a U-shaped bottom wall integrally connected to inner and outer U-shaped side walls.

36. The method of claim 35 wherein said light source comprises a series of light emitting devices.

37. The method of claim 35 wherein said light source comprises a plurality of light transmitting optic fibers.

38. A visible wavelength light source apparatus for polymerizing light curable dental material in the mouth, comprising:

an element having a shape and size conforming to at least a curved substantial portion of a dental arch and adapted to support light curable dental material, and

optical fibers supported within said element and positioned along at least a majority of the length of said element, said element comprising a U-shaped tray and a housing, said housing having U-shaped bottom and inner and outer side walls connected to form a trough adapted to support light curable material, said tray being adapted to be positioned within said trough.

39. A visible wavelength light source apparatus for polymerizing light curable dental material in the mouth, comprising:

an element having a shape and size conforming to at least a curved substantial portion of a dental arch, and

means for generating light in said element, said means for generating light being positioned along at least a majority of the length of said element said element including two sides connected in a U-shape.

40. The apparatus of claim 39 further comprising a light transmitting means adapted to be removably connected to said element, said light transmitting means being adapted to hold said dental material in proximity to said element.

41. The apparatus of claim 39 wherein said means for generating light comprises a plurality of light sources.

42. A dental light for polymerizing light curable dental material in the mouth, comprising: a light source transmitting visible wavelength light and having a U-shape and size conforming substantially to a dental arch and sized to fit in the mouth, said light source comprising a plurality of at least partially unclad optic fibers formed into a web, each of said unclad optic fibers

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having a U-shaped length of unclad fiber wall and being adapted for transmitting light along at least a portion of said length and delivering said light from said unclad fiber wall for polymerizing said light curable dental material in the mouth.

43. A method of curing dental material, comprising: providing an element having a U-shape and size conforming to a curved substantial portion of a dental arch and adapted to support light curable dental material, and optical fibers in said element positioned in a U-shape along at least a substantial portion of the length of said element,

positioning said element in a mouth adjacent to light curable dental material, and transmitting light from said optical fibers in a U-shape to said curable dental material.

44. A method of curing dental material, comprising: providing an element having a shape and size conforming to a curved substantial portion of a dental arch, and a light generator in said element positioned along at least a substantial portion of the length of said element,

positioning said element in a mouth adjacent to light curable dental material, and

transmitting light from said generator to said curable dental material wherein said light generator comprises a vacuum bulb.

45. A method of simultaneously uniformly curing dental impression material positioned in a patient's mouth, comprising simultaneously emitting light from a plurality of light emitting means positioned substantially uniformly along the length of said impression material.

46. The method of claim 45 wherein said light emitted from each of said light emitting means is of substantially equal intensity.

47. The method of claim 45 wherein said impression material and said light emitting means are supported in a U-shape.

48. A system for polymerizing light curable dental material in the mouth, comprising: an element.

said element having a U-shape and size conforming substantially to a configuration of a dental arch, means for generating light, said means for generating light comprising at least one electrical wire adapted to be connected to a power source, said means for generating light being supported by said element,

light transmitting means having a bottom member and two side members connected to said bottom member, and adapted to be positioned adjacent to said element, whereby light emitted from said element is transmitted through said light transmitting means into light curable dental material supported by said light transmitting means while said light transmitting means is in the mouth.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,316,473
DATED : May 31, 1994
INVENTOR(S) : Robert V. Hare

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In claim 36, column 15, line 15 of the Patent change
"method" to --dental light--.

In claim 37, column 15, line 17 of the Patent change
"method" to --dental light--.

Signed and Sealed this
Thirtieth Day of May, 1995

Attest:



BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/678,841	10/03/2003	James D. Cleary	59011US002	1146
32692	7590	07/05/2006	EXAMINER	
3M INNOVATIVE PROPERTIES COMPANY			BUMGARNER, MELBA N	
PO BOX 33427			ART UNIT	
ST. PAUL, MN 55133-3427			PAPER NUMBER	
			3732	

DATE MAILED: 07/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/678,841

Applicant(s)

CLEARY ET AL.

Examiner

Melba Bumgarner

Art Unit

3732

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 April 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 43-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 43-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) ☐ Notice of References Cited (PTO-892) | 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) ☐ Notice of Informal Patent Application (PTO-152) |
| 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) ☐ Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and, distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 44-47 and 51 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claims 44 and 51, it is unclear whether “a substrate” is in addition to the substrate of claim 43, and if so, which substrate is referred to in “the substrate” in line 2 of claim 51.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 43-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cohen et al. in view of Hare. Cohen et al. disclose a method of bonding orthodontic appliance to a patient's teeth comprising providing orthodontic appliance for at least two teeth, providing a quantity of photocurable material for each appliance, placing each orthodontic appliance on a corresponding tooth such that the material is between the appliance and the tooth, providing a substrate and an array of light emitters mounted on the substrate, placing the substrate and light emitters in the oral cavity adjacent the appliances (column 2 line 37), the light emitters lie along a path that is located in an occlusal direction, and activating the light emitters in order to direct light in a

Art Unit: 3732

gingival direction and toward the material; however, Cohen et al. do not show light emitters of solid state light emitters. Hare teaches a method comprising a substrate and an array of solid state light emitters (column 4 line 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the light emitters of Cohen et al. with the solid state light emitters placed to lie along a path that is located in an occlusal direction from the tips of the patient's teeth as in Hare (figure 2) in order to provide uniform emission and distribution of light to the intended area in view of Hare. The configuration of the substrate and array in Hare would direct also direct light from the light emitted in a gingival direction across the surfaces of the teeth when placed in the oral cavity. Cohen et al. show a substrate that comprises an indirect bonding placement device. The device comprises a shell having an overall, generally U-shaped configuration in plan view. The device has a channel that corresponds to the shape of at least a portion of the arch and the array is located adjacent the channel. The array extends along a longitudinal axis of the channel. The light is directed through light-transmissive matrix material. The substrate is generally flat. Substrates of a full dental arch as well as the size of approximately the length of a quadrant arch are well known in the art.

Response to Arguments

5. Applicant's arguments filed April 10, 2006 have been fully considered but they are not persuasive. Cohen et al. show the steps of photocuring orthodontic appliances to teeth with light emitters embedded in substrate and the light emitters adjacent the appliances when in the oral cavity. It is believed that what is deficient in Cohen et al. is taught in the structure that is shown Hare with respect to the type of light emitters and their placement in the substrate.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

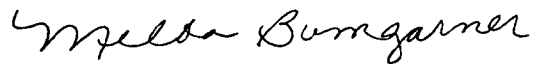
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melba Bumgarner whose telephone number is 571-272-4709. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Shaver can be reached at 571-272-4720. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 3732

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Melba Bumgarner
Primary Examiner

tal evidence in the final determination of obviousness. See MPEP § 706.02(j) for a discussion of the proper contents of a rejection under 35 U.S.C. 103.

2143 Basic Requirements of a *Prima Facie* Case of Obviousness

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Laeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

2143.01 Suggestion or Motivation To Modify the References [R-3]

➤

I. < THE PRIOR ART MUST SUGGEST THE DESIRABILITY OF THE CLAIMED INVENTION

"There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) (The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a *prima facie* case of obvious was held improper.). The level of skill in the art cannot be relied upon to provide the suggestion to combine references. *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999).

"In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before

him to make the proposed substitution, combination, or other modification." *In re Linter*, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also *In re Lee*, 277 F.3d 1338, 1342-44, 61 USPQ2d 1430, 1433-34 (Fed. Cir. 2002) (discussing the importance of relying on objective evidence and making specific factual findings with respect to the motivation to combine references); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

"In *In re Fulton*, 391 F.3d 1193, 73 USPQ2d 1141 (Fed. Cir. 2004), the claims of a utility patent application were directed to a shoe sole with increased traction having hexagonal projections in a "facing orientation." 391 F.3d at 1196-97, 73 USPQ2d at 1142. The Board combined a design patent having hexagonal projections in a facing orientation with a utility patent having other limitations of the independent claim. 391 F.3d at 1199, 73 USPQ2d at 1144. Applicant argued that the combination was improper because (1) the prior art did not suggest having the hexagonal projections in a facing (as opposed to a "pointing") orientation was the "most desirable" configuration for the projections, and (2) the prior art "taught away" by showing desirability of the "pointing orientation." 391 F.3d at 1200-01, 73 USPQ2d at 1145-46. The court stated that "the prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed...." *Id.* The court emphasized that the proper inquiry is "whether there is something in the prior art as a whole to suggest the *desirability*, and thus the obviousness, of making the combination," not whether there is something in the prior art as a whole to sug-

FULL TEXT OF CASES (USPQ2D)

All Other Cases

**In re Gorman (CA FC) 18 USPQ2d 1885 In re
Gorman**

**U.S. Court of Appeals Federal Circuit
18 USPQ2d 1885**

**Decided May 13, 1991
No. 90-1362**

Headnotes

PATENTS

1. Patentability/Validity - Obviousness - Combining references (§ 115.0905)

Patent and Trademark Office's reliance on teachings of large number of references in rejecting patent application for obviousness does not, without more, weigh against holding of obviousness on appeal, since criterion is not number of references, but whether references are in fields which are same as or analogous to field of invention, and whether their teachings would, taken as whole, have made invention obvious to person skilled in that field.

2. Patentability/Validity - Construction of claims (§ 115.03)

Patentability/Validity - Obviousness - In general (§ 115.0901)

Claim which describes features of invention in great detail is nevertheless obvious in

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view of prior art, since claim that is narrowly and specifically drawn must still meet requirements of 35 USC 103, and details listed in claim are shown in references and thus do not contribute to unobviousness.

3. Patentability/Validity - Obviousness - Relevant prior art - Particular inventions (§ 115.0903.03)

Patentability/Validity - Obviousness - Combining references (§ 115.0905)

Application claim for candy sucker on stick, molded in elastomeric mold in shape of human thumb, is obvious in view of prior art, since all elements of claim, including molded lollipop having chewing gum base plug, with elastomeric mold serving as product wrapper, and candy in shape of human thumb, are shown in prior art references in various subcombinations, used in same manner and for same purpose as in claimed invention.

Case History and Disposition:

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Appeal from the U.S. Patent and Trademark Office, Board of Patent Appeals and Interferences.

Patent application of Jeffrey B. Gorman and Marilyn Katz, serial no. 06/882,480 (composite food product). From decision of Board of Patent Appeals and Interferences upholding examiner's rejection of all claims in application, applicants appeal. Affirmed.

Attorneys:

Thomas W. Tolpin, Highland Park, Ill., for appellant.

Teddy S. Gron, associate solicitor (Fred E. McKelvey, solicitor, with him on brief), for appellee.

Judge:

Before Rich, Newman, and Rader, circuit judges.

Opinion Text

Opinion By:
Newman, J.

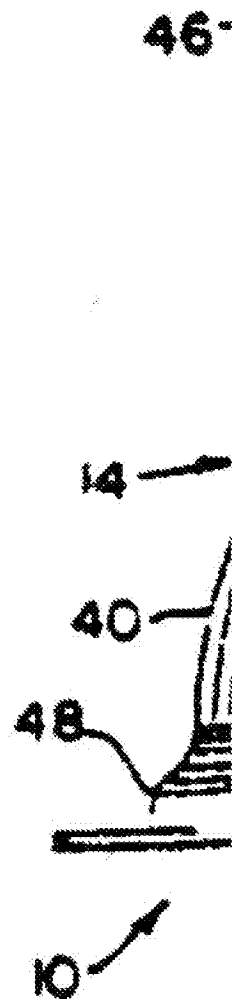
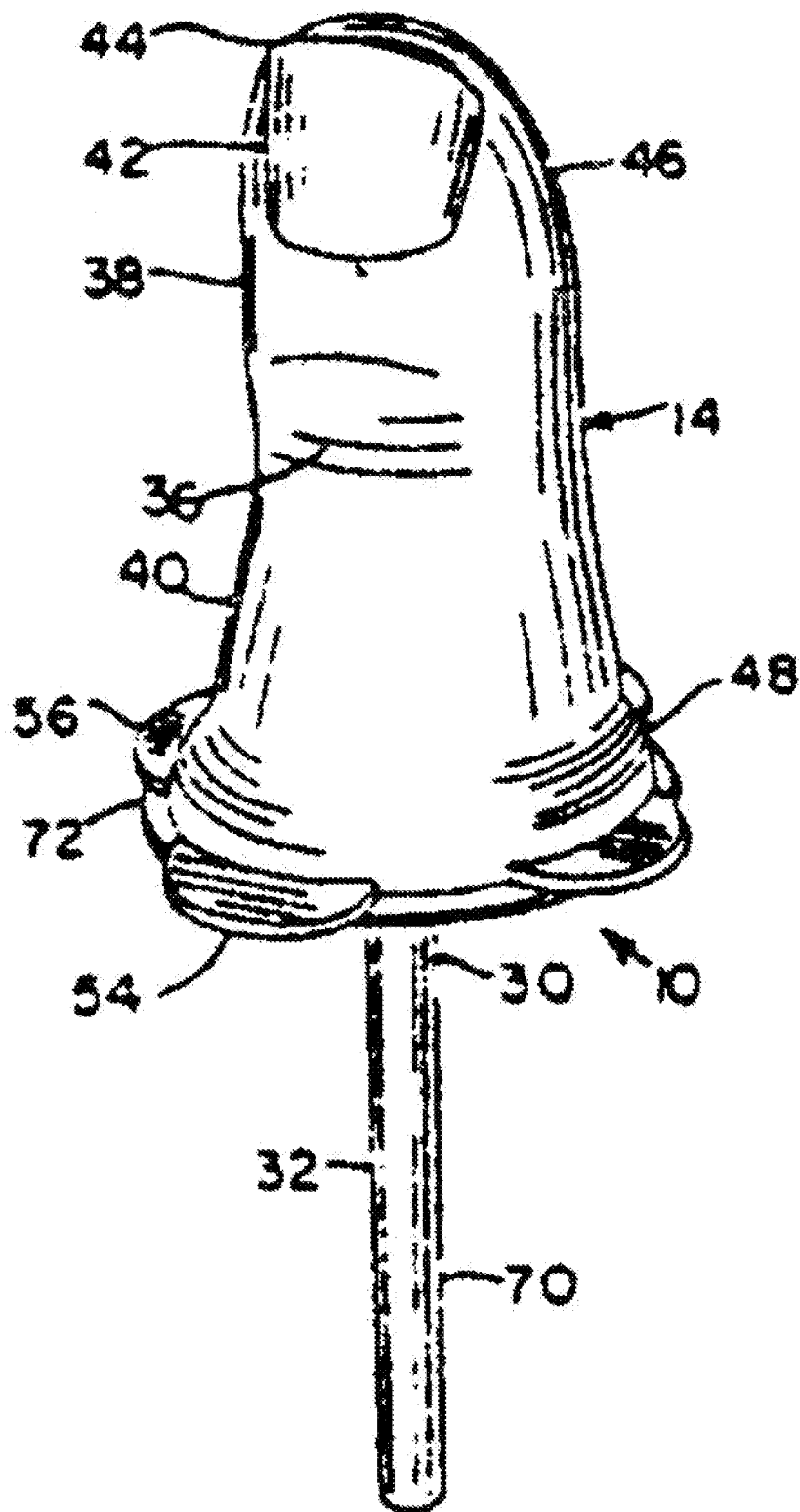
Jeffrey B. Gorman and Marilyn Katz (hereinafter "Gorman") appeal the decision of the United States Patent and Trademark Office, Board of Patent Appeals and Interferences (the "Board") denying patentability to all the claims of Gorman's patent application Serial No. 06/882,480, entitled "Composite Food Product." We affirm.

The Invention

The claimed invention is a composite candy sucker on a stick, molded in an elastomeric mold in the shape of a human thumb. During the manufacturing process liquid candy is poured into the mold, and an edible plug of bubble or chewing gum or chocolate or food-grade wax is poured into the mold after the candy has hardened, serving as a seal for the end portion of the candy. A paper or plastic disc abuts and covers the plug. The mold serves as a cover that can be removed from the candy by means of protruding flanges. The cover is described as a "toy and novelty item".

Figure 1 shows the invention in the form in which it is marketed. Figure 2 shows the cover partially removed to reveal the candy portion (12) and the chewable or edible plug (58):

FIG. 1



The claims describe the product in detail, as is apparent from claim 16, the claim pressed by Gorman in this appeal:

16. A composite food product, comprising:

a candy core, said candy core being in a generally liquified form when formulated,

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heated, blended and poured into a mold and in a substantially thumb-shaped hardened form when cooled and removed from said mold;

said thumb-shaped hardened form comprising said candy core positioned along a vertical axis and comprising a rigid joint-shaped portion, a rigid upper portion extending upwardly from said rigid joint-shaped portion along said vertical axis, and a rigid lower portion extending downwardly from said rigid joint-shaped portion along said vertical axis, said upper portion having a rigid finger nail-shaped portion with an upper rigid tip providing a rigid top end of said thumb-shaped hardened form and a rigid convex back extending rearwardly and downwardly from said rigid tip, and said rigid lower portion having a rigid bottom end and defining a recessed opening comprising a handle-receiving socket about said vertical axis;

a removable resilient shell comprising a substantially thumb-shaped, elastomeric material selected from the group consisting of rubber and flexible plastic, said shell providing a mold for receiving and molding said liquified candy form,

a removable outer protective cover positioned about and covering said hardened form comprising said candy core, and

a toy and novelty item for placement upon the thumb of the user when removed from said hardened form comprising said candy core;

said thumb-shaped elastomeric material comprising said removable resilient shell comprising a flexible joint-shaped portion, a flexible upper portion extending upwardly from said flexible joint-shaped portion along said vertical axis, and a flexible lower portion extending downwardly from said flexible joint-shaped portion along said vertical axis, said upper portion having a flexible finger nail-shaped portion with an upper flexible tip providing a flexible top end of said shell and a flexible convex back extending rearwardly and downwardly from said flexible tip, and said flexible lower portion having an enlarged open ended diverging base, said base having a larger circumference and transverse cross-sectional area than other portions of said shell and providing the bottom of said shell, said open ended base defining a plug-receiving chamber and an access opening for entrance of said liquified form and discharge of said hardened candy form, and a set of substantially symmetrical arcuate lobes extending radially outwardly from said base, said lobes being circumferentially spaced from each other and providing manually grippable flange portions to facilitate manual removal of said shell from said core;

a plug positioned in said plug-receiving chamber adjacent said bottom of said shell, said plug abutting against the bottom of said core and providing a cap for substantially plugging and sealing the open end of said mold and cover to help enclose said candy core, and said plug comprising a food grade material selected from the group consisting of bubble gum, chewing gum, chocolate, and food grade wax;

a handle having a connecting portion connected to said plug and said candy core and

positioned in said plug-receiving opening and having a manually grippable handle portion extending downward from said connecting portion along said vertical axis; and a substantially planar annular disk for abuttingly engaging and removably seating against said base and said lobes adjacent said plug, said disk defining a central axial hole for slidably receiving said handle portion and having an outer edge with a maximum span larger than said access opening but less than the maximum diameter of said symmetrical set of lobes to substantially minimize the interference with manually gripping of said manual grippable flange portions of said lobes, said disk being of a material selected from the group consisting of paper, paperboard, and plastic, and providing a removable closure member and seal for substantially closing said access opening and sealing said plug and said candy core within said shell.

The claims were rejected in view of thirteen references. The primary references, patents to Siciliano, Copeman, and Pooler, show ice cream or candy molded in a plastic, rubber or elastomeric mold. In Siciliano and Copeman the mold also serves as the product wrapper. In Siciliano the ice cream is poured into the mold, a stick is inserted, the ice cream is hardened, and a cardboard cover seals the area between the stick and the elastomeric wrapper. Copeman and Kuhlke show candy lollipops molded in elastomeric molds. Copeman states that the mold may take "varying shapes, such as in the form of fruit, or animals" and Kuhlke discusses the desirability of sealing candy from the outside air. In Siciliano, Copeman and Kuhlke, the mold is peeled from the confection prior to use.

The two Nolte patents teach that gripping flanges may be placed on an ice cream wrap

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per to facilitate removal. Ahern and Knaust each show a disc-shaped seal or cover for a frozen confection. Ahern shows the cover in conjunction with ice cream on a stick. Harris shows a hollow thumb-shaped lollipop into which the thumb is inserted, and Craddock shows a thumb-shaped confection supported on a disc-shaped handle; in both cases without the other elements shown by Gorman. Fulkerson shows a candy coating surrounding a block of ice cream, and a candy plug for retaining liquid syrup inside a cavity in the ice cream. Webster shows chewing gum entirely enclosing a liquid syrup product. Spiegel shows a chocolate layer having an alcohol diffusion barrier to plug the end of a plastic container of liqueur. Fulkerson, Webster and Spiegel all suggest the greater appeal to consumers of providing two different components in the same confection.

The Board found that all of the features of Gorman's product were known to the art, and that various combinations of these elements existed in known similar structures. The Board concluded that the applicant's claimed combination was suggested by and would have been obvious in light of the references.

Discussion

A

Each element of the Gorman claims is in the prior art, separately or in sub-combination. Gorman argues that when it is necessary to combine the teachings of a large number of

references in order to support a rejection for obviousness under 35 U.S.C. §103, this of itself weighs against a holding of obviousness.

[1] The criterion, however, is not the number of references, but what they would have meant to a person of ordinary skill in the field of the invention. In *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1383, 231 USPQ 81, 93 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987), the court held that a combination of about twenty references that "skin[ed] all around" the claimed invention did not show obviousness. In other instances, on other facts, we have upheld reliance on a large number of references to show obviousness. Compare *In re Miller*, 159 F.2d 756, 758-58, 72 USPQ 512, 514-15 (CCPA 1947) (rejecting argument that the need for eight references for rejection supported patentability) with *Kansas Jack, Inc. v. Kuhn*, 719 F.2d 1144, 1149, 219 USPQ 857, 860 (Fed. Cir. 1983) (where teachings relied upon to show obviousness were repeated in a number of references, the conclusion of obviousness was strengthened). See also, e.g., *In re Troitel*, 274 F.2d 944, 947, 124 USPQ 502, 504 (CCPA 1960) (rejecting appellant's argument that combining a large number of references to show obviousness was "farfetched and illogical").

Determination of whether a new combination of known elements would have been obvious to one of ordinary skill depends on various facts, including whether the elements exist in "analogous art", that is, art that is reasonably pertinent to the problem with which the inventor is concerned. *In re Deminski*, 796 F.2d 436, 442, 230 USPQ 313, 315 (Fed. Cir. 1986). When the references are all in the same or analogous fields, knowledge thereof by the hypothetical person of ordinary skill is presumed. *In re Sernaker*, 702 F.2d 989, 994, 217 USPQ 1, 5 (Fed. Cir. 1983), and the test is whether the teachings of the prior art, taken as a whole, would have made obvious the claimed invention. See *In re Young*, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991).

When it is necessary to select elements of various teachings in order to form the claimed invention, we ascertain whether there is any suggestion or motivation in the prior art to make the selection made by the applicant. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985). "Obviousness can not be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination." *In re Bond*, 910 F.2d 831, 834, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990) (quoting *Carella v. Starlight Archery and Pro Line Co.*, 804 F.2d 135, 140, 231 USPQ 644, 647 (Fed. Cir. 1986)).

The extent to which such suggestion must be explicit in, or may be fairly inferred from, the references, is decided on the facts of each case, in light of the prior art and its relationship to the applicant's invention. As in all determinations under 35 U.S.C. §103, the decisionmaker must bring judgment to bear. It is impermissible, however, simply to engage in a hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps.

Interconnect Planning, 774 F.2d at 1143, 227 USPQ at 551. The references themselves must provide some teaching whereby the applicant's combination would have been obvious.

B

Gorman argues that the references showing ice cream in a mold or wrapper on a stick and the references showing candy in a mold or wrapper on a stick are not analogous, for they require different conditions of production. However, the Copeman reference shows the close relationship of these arts, stating that his elastomeric mold may be used for "frozen confections and other solid confections". We conclude that the ice cream on a stick and candy on a stick arts are analogous, and that the Siciliano, Copeman, Pooler, and Kuhlke references show or suggest Gorman's candy on a stick and covered with an elastomeric mold, for which the thumb-shape is shown by Harris or Craddock.

The suggestion of providing a layer of chewing gum, chocolate or the like, surrounding the candy core in the area not covered by the mold, to seal the candy and provide a second food product, is provided by Fulkerson, Webster, or Spiegel. The paper disc adjacent the base of the candy structure is shown in Ahern and Knaust. Harris and Craddock both show thumb-shaped candy. Gorman argues that the prior art does not suggest using the thumb-shaped cover as a toy after the candy is removed. However, Copeman states that his rubber mold may be used as a "toy balloon" after the candy is removed. Gorman argues that Craddock teaches away from the claimed invention because of Craddock's admonition that lollipops on sticks are dangerous to children. However, candy on a stick is too well known for this caution to contribute to unobviousness.

[2] Claim 16 recites details such as a "joint-shaped portion", a "finger nail portion", an "upper portion", a "lower portion" and a "convex back", as descriptive of the thumb shape. Such details are shown in the references and do not contribute to unobviousness. A claim that is narrowly and specifically drawn must nevertheless meet the requirements of §103:

The mere fact that a claim recites in detail all of the features of an invention (i.e., is a "picture claim") is never, in itself, justification for the allowance of such a claim.

Manual of Patent Examining Procedure, §706 (Rev. 6, Oct. 1987) at p. 700-6; *In re Romito*, 289 F.2d 518, 129 USPQ 359 (CCPA 1961) (rejecting a "picture claim").

[3] Applying the principles of *Graham v. John Deere & Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), we discern all of the elements of claim 16, used in substantially the same manner, in devices in the same field of endeavor. The various elements Gorman combined: the molded lollipop with a chewing gum plug, with the mold serving as the product wrapper; and candy in the shape of a thumb; are all shown in the cited references in various sub-combinations, used in the same way, for the same purpose as in the claimed invention. The Board did not, as Gorman argues, pick and choose among isolated and inapplicable disclosures in the prior art. Rather, the claim elements appear in the prior art in the same configurations, serving the same functions, to achieve the results suggested in prior art. *In re Sernaker*, 702 F.2d at 994, 217 USPQ at 5. The large number of cited references does not negate the obviousness of the combination, for the prior art uses the various elements for the same purposes as they are used by appellants, making the claimed invention as a whole obvious in terms of 35 U.S.C. §103.

The Board's decision is *AFFIRMED*.

- End of Case -

FULL TEXT OF CASES (USPQ2D)

All Other Cases

**Princeton Biochemicals Inc. v. Beckman Coulter Inc.,
75 USPQ2d 1051 (CA FC 2005)**

75 USPQ2D 1051

Princeton Biochemicals Inc. v. Beckman Coulter Inc.

U.S. Court of Appeals Federal Circuit

No. 04-1493

Decided June 9, 2005

Headnotes

PATENTS

[1] Patentability/Validity — Obviousness — References and claims as whole (§115.0904)

Patentability/Validity — Obviousness — Combining references (§115.0905)

Asserted claim of patent for capillary electrophoresis device would have been obvious at time of invention in view of combination of prior art references, since evidence shows that all eight elements of asserted claim were separately known in prior art, since infringement defendant offered un rebutted expert testimony stating that both individual ideas

underlying invention and combination thereof would have been obvious, and such testimony is consistent with prior art introduced at trial, since expert supplied detailed analysis of prior art and reasons why person of ordinary skill would possess knowledge and motivation to combine elements, and since nature of problem addressed by invention called for solutions existing in prior art, as well as claimed combination of closely related prior art elements.

[2] Patentability/Validity — Obviousness — Relevant prior art — Particular inventions (§115.0903.03)

Federal district court hearing action for infringement of patent for capillary electrophoresis apparatus properly concluded that references on which it based its obviousness analysis, including those within related field of liquid chromatography, were appropriate prior art, since, during prosecution, examiner consistently rejected first six elements of asserted claim as obvious, citing references ranging from capillary electrophoresis to liquid chromatography, since district court itemized other references in chemical separations field, describing their relation to electrophoretic separation, chromatography, or both, and further established that capillary electrophoresis is closely related to types of electrophoresis described in some of cited references, since defendant's expert testified that person of ordinary skill in art would look to these related fields to solve problems in capillary electrophoresis field, and since district court examined whether references were reasonably pertinent to particular problems addressed by asserted claim, and properly determined that references addressed those problems in same manner as elements of claim.

Particular Patents

Particular patents — Chemical — Electrophoresis

5,045,172, Guzman, capillary electrophoresis apparatus, judgment of invalidity affirmed.

Case History and Disposition

Appeal from the U.S. District Court for the District of New Jersey, Cooper, J.

Action by Princeton Biochemicals Inc. against Beckman Coulter Inc.

for patent infringement. Jury found for plaintiff on issues of validity and infringement, but district court granted defendant's motion for judgment as matter of law, holding patent in suit invalid for obviousness. Plaintiff appealed. Affirmed.

Prior decision: 45 USPQ2d 1757.

Attorneys:

William G. Todd and Scott J. Bornstein, of Greenberg Traurig, New York, N.Y., for plaintiff-appellant.

Joseph R. Re, Darrell L. Olson, Douglas G. Muehlhauser, and Christy G. Lea, of Knobbe, Martens, Olson & Bear, Irvine, Calif., for defendant-appellee.

Judge:

Before Rader, Schall, and Gajarsa, circuit judges.

Opinion Text

Opinion By:

Rader, J.

In the United States District Court for the District of New Jersey, a jury found in favor of Plaintiff-Appellant Princeton Biochemicals, Inc. (Princeton), rejecting the claims of Defendant-Appellee Beckman Coulter, Inc. (Beckman) that Princeton's U.S. Patent No. 5,045,172 (the '172 patent) is invalid by reason of obviousness and prior invention, and finding that Beckman infringed the '172 patent. On all three questions, however, the district court found the jury's verdict unsupported by substantial evidence and granted judgment as a matter of law (JMOL) in favor

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of Beckman. *Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.*, No. 96-5541 (MLC), 2004 WL 1398227 (D.N.J. June 17, 2004). Because the district court properly concluded that substantial evidence did not support the jury's verdict of nonobviousness, this court affirms.

I.

Dr. Norberto Guzman is the inventor of the '172 patent, which he assigned to Princeton. The '172 patent claims a capillary electrophoresis device. Electrophoresis is one method available for the investigation of biological materials, and is an efficient procedure for the separation and detection of proteins and other matter. '172 patent, col. 1, ll. 16-20. Electrophoretic separation, one species of electrophoresis, relies on the

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differential speeds of the migration of differently charged particles in an electric field. *Id.* at col. 1, ll. 21-23. Capillary electrophoresis is one type of electrophoretic separation. *Id.* at col. 1, ll. 17-20. As the '172 patent describes,

[I]t is generally known that a material, containing mixtures of substances to be analyzed, can be passed along a capillary tube and through a detector under the influence of an applied voltage. The applied voltage charges the substances and the charges on the substances determine their spacing and their speed of passage along the capillary tube.

Id. at col. 2, ll. 32-38. Capillary tubes, generally made of quartz, range in lengths of roughly 10 to 100 centimeters and 25-200 microns in diameter. *Id.* at col. 1, ll. 50-58. Due to the dimensions of a tube, capillary electrophoresis requires only a minute sample size to efficiently separate and identify the components of a solution.

Claim 32 of the '172 patent claims a specific capillary electrophoresis device:

Capillary electrophoresis apparatus comprising a capillary tube of the type which can be electrically charged, said capillary tube having first and second ends,
first means at said first end of said capillary tube providing a source of buffer solution and a source of a sample substance to be analyzed,
second means coupled to said apparatus for applying electrical potential across said capillary tube whereby a sample flows through said capillary tube and past said detector,
said first means includes a rotatable table carrying a plurality of sample cups and *a holder for holding an end of said capillary tube in operative relation with one of the said cups*,
said cups containing either buffer solution or a sample to be analyzed, and
*said capillary tube is in the form of a coil of glass tubing [secured to a support member].**

Id. at col. 23, ll. 30-47 (emphases added). The parties stipulated that claim 32 contains eight elements, as follows:

Capillary electrophoresis apparatus comprising:

- (1) a capillary tube of the type which can be electrically charged,
- (2) said capillary tube having first and second ends,
- (3) first means at said first end of said capillary tube providing a source of buffer solution and a source of sample substance to be analyzed,
- (4) second means coupled to said apparatus for applying electrical potential across said capillary tube whereby a sample flows through said capillary tube and past said detector,
- (5) said first means includes a rotatable table carrying a plurality of sample cups and
- (6) a holder for holding an end of said capillary tube in operative relation with one of the said cups, said cups containing either buffer solution or a sample to be analyzed, and
- (7) said capillary tube is in the form of a coil of glass tubing
- (8) secured to a support member. *Id.*

Beckman manufactures and sells the P/ACE 2000 and 5000 Series capillary electrophoresis devices ("the accused devices" or

"the P/ACE devices"). Beckman contends a prototype device, named OTEP II, contained all the elements recited in claim 32. Princeton does not contest that Beckman made OTEP II by February 1, 1987. That date, therefore, is the relevant reduction-to-practice date for the P/ACE devices. Beckman began selling P/ACE devices as early as 1993.

Guzman filed the application for the '172 patent on November 14, 1988. Thus, the critical date for evaluating 35 U.S.C. §102(b) prior art references is November 14, 1987. Several references, published before November 14, 1987, discussed the electrophoretic concepts embodied in claim 32 of the '172 patent. Two particular references stand out. The first, an article by Honda dated September 1987, describes ways to introduce automatically different samples into a capillary electrophoresis device. Susumu Honda, et. al., "Evaluation of an Automatic Siphonic Sampler for Capillary Zone Electrophoresis," *Int'l J. on Chromatography, Electrophoresis and Related Methods*. The second, a Ph.D. thesis by Lukacs, was published in 1983 by a graduate student of Dr. James W. Jorgenson, an expert who testified on behalf of Beckman. The Lukacs thesis discloses the coiling of capillary tubes during electrophoretic work. Coiling a capillary tube lengthens the tubing without increasing the size of the electrophoretic device. A longer tube provides better separation and identification of analytes.

On November 21, 1996, Princeton filed suit, alleging that the P/ACE devices infringed claim 32 of the '172 patent. Beckman denied infringement and sought a declaration of invalidity on grounds of obviousness and prior invention. Following a grant of summary judgment of noninfringement, Princeton appealed. In an unpublished opinion, this court reversed, holding that the district court had improperly construed the sixth element in claim 32. *Princeton Biochemicals, Inc. v. Beckman Instruments, Inc.*, 1999 WL 641233, at *6 (Fed. Cir. 1999) ("The proper interpretation of the holder limitation is that 'in operative relation' encompasses both vertical movement of the holder as well as vertical movement of the sample cups and the table.").

On remand, the district court conducted a nine-day trial followed by motions for JMOL from both parties. The district court reserved judgment until after the jury verdict. The jury decided in favor of Princeton on all issues. Specifically, the jury found that Princeton proved by a preponderance of the evidence that Beckman's devices infringed claim 32 of the '172 patent; that Beckman did not prove by clear and convincing evidence that claim 32 of the patent was invalid for obviousness; and finally, that Beckman did not prove "by clear and convincing evidence that claim 32 is invalid because the invention described in that claim was made by Beckman before it was made by Princeton." Beckman timely renewed its JMOL motion and moved alternatively for a new trial.

In due course, the district court issued a carefully composed, 194-page opinion that set aside the jury's verdict and found all counts in favor of Beckman. *Princeton Biochemicals, Inc.*, 2004 WL 1398227. The district court also granted Beckman's motion for a new trial. *Id.* at *91. Princeton timely appealed to this court. This court has jurisdiction under 28 U.S.C. §1295(a)(1).

II.

"The grant or denial of a motion for judgment as a matter of law is a procedural issue not unique to patent law, reviewed under the law of the regional circuit in which the appeal from the district court would usually lie." *Summit Tech., Inc. v. Nidek Co.*, 363 F.3d 1219, 1223 [70 USPQ2d 1276] (Fed. Cir. 2004). Under the law of the Third Circuit, review of a district court's ruling on JMOL is plenary. *Shellenberger v. Summit Bancorp, Inc.*, 318 F.3d 183, 186 (3rd Cir. 2003). The party requesting the JMOL must show that substantial evidence did not support the jury's findings, where substantial evidence is "such relevant evidence from the record taken as a whole as might be accepted by a reasonable mind as adequate to support the finding under review." *Tex. Instruments Inc. v. Cypress Semiconductor Corp.*, 90 F.3d 1558, 1563 [39 USPQ2d 1492] (Fed. Cir. 1996). This court must also consider all the evidence before the jury and draw all reasonable inferences in favor of the prevailing party on that issue, i.e., the non-movant. *Richardson-Vicks Inc. v. Upjohn Co.*, 122 F.3d 1476, 1479 [44 USPQ2d 1181] (Fed. Cir. 1997). Regarding the obviousness issue in this case, this court must determine whether the jury had substantial evidence upon which to conclude that Beckman

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met its burden of showing invalidity by clear and convincing evidence.

This court also reviews the legal standards that the jury applied in reaching its verdict to determine whether they were correct as a matter of law. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 975 [34 USPQ2d 1321] (Fed. Cir. 1995) (*en banc*), *aff'd*, 517 U.S. 370, 134 L. Ed. 2d 577, 116 S. Ct. 1384 [38 USPQ2d 1461] (1996). When reviewing a jury's verdict on obviousness the court reviews the "conclusions on obviousness, a question of law, without deference, and the underlying findings of fact, whether explicit or implicit within the verdict, for substantial evidence." *LNP Eng'g Plastics, Inc. v. Miller Waste Mills, Inc.*, 275 F.3d 1347, 1353 [61 USPQ2d 1193] (Fed. Cir. 2001). Specifically, the jury is presumed to have "resolved the underlying factual disputes in favor of the verdict winner and [this court leaves] those presumed findings undisturbed if they are supported by substantial evidence". *Jurgens v. McKasy*, 927 F.2d 1552, 1557 [18 USPQ2d 1031] (Fed. Cir. 1991).

III.

Section 103 of title 35 of the United States Code states:

A patent may not be obtained ... if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

35 U.S.C. §103(a) (2000). The legal conclusion, that a claim is obvious within §103(a), depends on at least four underlying factual issues: (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the pertinent art; and (4) evaluation of any relevant secondary considerations. *See*

Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17 [148 USPQ 459] (1966).

Analyzing the record support for those factors for Beckman's Rule 50(b) motion, the trial court concluded that claim 32 was obvious. Thus, the court granted Beckman's motion for JMOL, set aside the jury verdict rejecting the obviousness challenge, and entered judgment invalidating claim 32.

There is no dispute that the references introduced at trial disclosed every element in claim 32. Guzman admitted this in his testimony at trial. Thus, aside from the relevance of the asserted references, the only disputed issue at trial, and asserted on appeal, was whether there was motivation to combine the elements already present in the prior art. As this court outlined in *Rutz v. A.B. Chance Co.*, 357 F.3d 1270, 1275 [69 USPQ2d 1686] (Fed. Cir. 2004), in making the assessment of differences between the prior art and the claimed subject matter, section 103 specifically requires consideration of the claimed invention "as a whole." Inventions typically are new combinations of existing principles or features. *Envil Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 698 [218 USPQ 865] (Fed. Cir. 1983) (noting that "virtually all [inventions] are combinations of old elements"). The "as a whole" instruction in title 35 prevents evaluation of the invention part by part. *Rutz*, 357 F.3d at 1275. Without this important requirement, an obviousness assessment might successfully break an invention into its component parts, then find a prior art reference corresponding to each component. *Id.* This line of reasoning would import hindsight into the obviousness determination by using the invention as a roadmap to find its prior art components. Further, this improper method would discount the value of combining various existing features or principles in a new way to achieve a new result – often the essence of invention. *Id.*

Contrary to this reasoning, section 103 requires assessment of the invention as a whole. *Id.* This "as a whole" assessment of the invention requires a showing that an artisan of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the various elements from the prior art and combined them in the claimed manner. *Id.* In other words, section 103 requires some suggestion or motivation, before the invention itself, to make the new combination. *See In re Rouffet*, 149 F.3d 1350, 1355-56 [47 USPQ2d 1453] (Fed. Cir. 1998).

[1] In setting aside the jury's verdict and holding claim 32 obvious, the district court systematically and vigilantly considered the relevant prior art references and testimony of

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both parties. The Honda article relates to claim 32's first six elements and describes an automated capillary electrophoresis device with a rotatable table carrying a plurality of sample cups. Princeton does not contest that the Honda article discloses elements one through six. Therefore, at the time of Princeton's claim 32 invention, the prior art had disclosed elements one through six.

With respect to the seventh element, the district court found that the Lukacs thesis

disclosed the construction and use of a coiled glass capillary in a capillary electrophoresis apparatus. *Princeton Biochemicals, Inc.*, 2004 WL 1398227, at *40. Additionally, Dr. Jorgenson testified about Ms. Lukacs's work with coiled capillaries based on his own observations in the laboratory with Ms. Lukacs. He noted that they coiled glass capillaries that were two to three meters and longer. *Id.* at *24. In light of the Lukacs thesis, Dr. Guzman conceded at trial that he was not the first to coil a capillary in an electrophoresis device. *Id.* at *40. Therefore, at the time of Princeton's claim 32 invention, element 7 was also known in the prior art.

Element 8 of claim 32 recites the requirement that the capillary tube of claim 32, in the form of glass tubing, must be "secured to a support member." At trial, Dr. Guzman testified that he did not invent "securing capillary tubes or any portion thereof to support members" and did not deny that this element was "old" or that it did not "add" anything new to the claim. From this, the district court correctly concluded that element 8 was known in the prior art. *Id.* at *40. Furthermore, in its brief to this court, Princeton conceded that elements one through eight were separately known in the prior art.

As discussed, simply identifying all of the elements in a claim in the prior art does not render a claim obvious. *Ruiz*, 357 F.3d at 1275. Instead section 103 requires some suggestion or motivation in the prior art to make the new combination. *Rouffet*, 149 F.3d at 1355-56. A suggestion or motivation to modify prior art teachings may appear in the content of the public prior art, in the nature of the problem addressed by the invention, or even in the knowledge of one of ordinary skill in the art. *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1356 [55 USPQ2d 1927] (Fed. Cir. 2000).

Dr. Jorgenson testified that the motivation to combine these references was found in the knowledge of those skilled in the art at the time of Guzman's invention. *See SIBIA Neurosciences, Inc.*, 225 F.3d at 1356 (stating that motivation, suggestion or reason to combine items of prior art may come from the knowledge of one of ordinary skill in the art). As Jorgenson explained:

[T]he combination is obvious. Every one of the individual ideas is obvious. And the combination is absolutely obvious. Everybody in all of the related fields in all of the related technologies is doing those kinds of things The entire package taken together is obvious.

Id. Princeton offered no evidence to rebut Dr. Jorgenson's testimony.

Dr. Jorgenson's testimony on motivation to combine is un rebutted. Moreover, it is consistent with the prior art introduced at trial. The only additions to the Honda prior art in this invention were coiling the capillaries (Lukacs prior art) and supporting the coils (concededly prior art). Both of those simple additions appear in other prior art references. Thus, Dr. Jorgenson testified, without any rebutting evidence in the record, that the suggestion to coil and secure the capillaries in the Honda device was within the knowledge of one of skill in the art. In *In re Lee*, this court expressed skepticism about invoking the knowledge of a skilled artisan to supply the motivation to combine on a scanty record. 277 F.3d 1338, 1343-44 [61 USPQ2d 1430] (Fed. Cir. 2002) ("This factual question of motivation ... could not be resolved on subjective belief and unknown

authority.”). Dr. Jorgenson supplied detailed analysis of the prior art and the reasons that one of ordinary skill would possess knowledge and motivation to combine these simple elements.

In addition, the nature of the problem supplies a motivation to combine these prior art references. The district court provided a detailed analysis of the nature of the problem solved by the invention. *Princeton Biochemicals, Inc.*, 2004 WL 1398227, at *37-40. The problem was lengthening and securing the capillaries on the Honda automatic device to produce better separation. *Id.* at *38. The prior art Lukaes thesis stated that lengthening was precisely the reason for coiling. *Id.* at *39. With regard to securing, Dr. Osborne, a Beckman

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witness, testified about the problem of a capillary electrophoresis device whose capillary swayed during use and affected the separation result. *Id.* Dr. Osborne observed: “[W]e did not want the capillary to move during the separation.” *Id.* In other words, the nature of the problem called for exactly the solutions in the prior art. Moreover the nature of the problem, as noted again in Dr. Jorgenson’s testimony, called for the combination. Dr. Jorgenson observed that the problem called for coiled electrophoresis tubes, including capillary tubes, secured in place in a variety of ways. *Id.* He also testified that one of ordinary skill in the art at the time of the invention would know to coil a capillary to save space. *Id.* Regarding the securing of a capillary tube to a support member, Dr. Jorgenson also testified that it would be obvious to one of ordinary skill in the art to do so, as “you don’t want a coil floating around without some kind of support.” *Id.* Thus, the nature of the problem also supplies a motivation to make this combination of closely related prior art elements.

The district court also properly found that the references for this obviousness analysis were proper prior art. A reference is appropriate prior art if within the field of the inventor’s endeavor. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 449 [230 USPQ 416] (Fed. Cir. 1986). Alternatively, a reference qualifies as prior art if “reasonably pertinent to the particular problem with which the inventor was involved.” *Id.* “A reference is reasonably pertinent if, even though it may be in a different field of endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to an inventor’s attention in considering his problem.” *In re GPAC Inc.*, 57 F.3d 1573, 1578 [35 USPQ2d 1116] (Fed. Cir. 1995) (quotations and citations omitted). If a reference’s disclosure relates to the same problem as the claimed invention, “that fact supports use of that reference in an obviousness rejection.” *In re Clay*, 966 F.2d 656, 659 [23 USPQ2d 1058] (Fed. Cir. 1992).

[2] In this case, all the references for obviousness constitute analogous art, even though some of the references fall within the related field of liquid chromatography. Throughout the prosecution history of the ‘172 patent, the examiner consistently rejected elements one through six of claim 32 as obvious, citing references ranging from capillary

electrophoresis to liquid chromatography – a related means of separating analytes. The examiner stated on the record: “[L]iquid chromatography and capillary electrophoresis are closely related techniques.” The district court also itemized other references in the chemical separations field, describing the relation to electrophoretic separation or chromatography or both. *Princeton Biochemicals, Inc.*, 2004 WL 1398227, at *36-37. The district court further established that capillary electrophoresis is closely related to the types of electrophoreses described in some of the references. *Id.* at *37. Finally, Dr. Jorgenson offered expert testimony that one of ordinary skill in the art would look to these related fields to solve problems in the field of capillary electrophoresis. *Id.* at *37.

The district court also examined whether the prior art references were reasonably pertinent to the particular problems with which the invention of claim 32 was involved. *Id.* at *37-39. In defining such problems, the district court looked to Dr. Guzman’s own testimony that the electrophoretic device needed to be compact and immobile. *Id.* at *38. As already noted, the district court properly assessed that the prior art references addressed those same problems in the same way. *Id.* at *39. In sum, the district court used proper prior art references in its correct obviousness analysis.

Viewing the evidence as a whole and in a light most favorable to Princeton, this court agrees with the district court that there was not substantial evidence to support the jury verdict. Because claim 32 is invalid for obviousness, this court need not reach the issues of prior invention and infringement.

COSTS

Each party shall bear its own costs.

AFFIRMED

Footnotes

* The words “secured to a support member” are not present in the final, published version of the ’172 patent. The parties stipulated at trial that this was a printing error only. Those words appear in claim 32 as issued.

- End of Case -

FULL TEXT OF CASES (USPQ2D)

All Other Cases

In re Rouffet (CA FC) 47 USPQ2d 1453 In re Rouffet**U.S. Court of Appeals Federal Circuit
47 USPQ2d 1453****Decided July 15, 1998
No. 97-1492****Headnotes****PATENTS****1. Patentability/Validity -- Obviousness -- Combining references (§ 115.0905)**

Claimed low orbit satellite communications system for mobile terminals, which addresses problem of minimizing "handover" of receiver from beam footprint of one transmitting satellite to that of another through use of multiple fan-shaped beams, is not prima facie obvious over combination of three prior art references, since critical reference that teaches use of fan-shaped beam to transmit from ground station to orbiting satellites does not specifically address handover minimization, and to extent it addresses handover problem at all, does so with orbit selection rather than beam shape, and since there is no reason one of ordinary skill in art, seeking to minimize handovers due to satellite motion, would have been motivated to combine this reference with remaining references in manner that would render claimed invention obvious.

**2. Patentability/Validity -- Obviousness -- Person of ordinary skill in art
(§ 115.0902)**

Patentability/Validity -- Obviousness -- Combining references (§ 115.0905)

Three possible sources for motivation to combine prior art references in a manner that would render claimed invention obvious are nature of problem to be solved, teachings of prior art, and knowledge of persons of ordinary skill in art; high level of skill in field of art cannot be relied upon to provide necessary motivation absent explanation of what specific understanding or technical principle, within knowledge of ordinary skill in art, would have suggested combination, since, if such rote invocation could suffice to supply motivation to combine, more sophisticated scientific fields would rarely, if ever, experience patentable technical advance.

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3. Patentability/Validity -- Obviousness -- Person of ordinary skill in art (§ 115.0902)**Patentability/Validity -- Obviousness -- Combining references (§ 115.0905)**

Claimed low orbit satellite communications system for mobile terminals is not prima facie obvious over combination of two prior art references, even though person possessing high level of skill characteristic of this field would know to account for differences between claimed invention and prior art combination, since high level of skill in art, without more, cannot supply required motivation to combine references, and does not overcome absence of any actual suggestion to combine; obviousness rejection will not be upheld, even where skill in art is high, absent specific identification of principle, known to one of ordinary skill, that suggests claimed combination.

Case History and Disposition:

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Appeal from the U.S. Patent and Trademark Office, Board of Patent Appeals and Interferences.

Patent application of Denis Rouffet, Yannick Tanguy, and Frederic Berthault, serial no. 07/888,791, filed May 27, 1992. From decision upholding examiner's final rejection of application as obvious under 35 USC 103(a), applicants appeal. Reversed.

Attorneys:

Richard C. Turner and Grant K. Rowan, of Sughrue, Mion, Zinn, Macpeak & Seas, Washington, D.C., for appellants.

David J. Ball Jr., associate solicitor, Nancy J. Linck, solicitor, Albin F. Drost, deputy solicitor, Craig R. Kaufman, associate solicitor, and Scott A. Chambers, associate solicitor, U.S. Patent and Trademark Office, Arlington, Va., for appellee.

Judge:

Before Plager, circuit, judge, Archer, senior circuit judge, and Rader, circuit judge.

Opinion Text**Opinion By:**

Rader, J.

Denis Rouffet, Yannick Tanguy, and Frederic Berthault (collectively, Rouffet) submitted application 07/888,791 (the application) on May 27, 1992. The Board of Patent Appeals and Interferences (the Board) affirmed final rejection of the application as obvious under 35 U.S.C. Section 103(a). See *Ex parte Rouffet*, No. 96-1553 (Bd. Pat. App. & Int. Apr. 16, 1997). Because the Board reversibly erred in identifying a motivation to combine the references, this court reverses.

I.

Satellites in a geosynchronous or geostationary orbit remain over the same point on the Earth's surface. Their constant position above the Earth's surface facilitates communications. These satellites project a number of beams to the Earth. Each beam transmits to its area of coverage, or footprint, on the Earth's surface. In order to provide complete coverage, adjacent footprints overlap slightly and therefore must use different frequencies to avoid interference. However, two or more non-overlapping footprints can use the same set of frequencies in order to use efficiently the limited radio spectrum. Figure 1 from the application shows the coverage of a portion of the Earth's surface provided by multiple cone shaped beams:



Frequency reuse techniques, however, have a limited ability to compensate for congestion in geostationary orbits. To alleviate the orbit congestion problem, new telecommunications systems use a network of satellites in low Earth orbit. When viewed from a fixed point on the Earth's surface, such satellites do not remain stationary but move overhead. A satellite's motion as it transmits a plurality of cone-shaped beams creates a new problem. The satellite's movement causes a receiver on the Earth's surface

to move from the footprint of one beam into a second beam transmitted by the same satellite. Eventually, the satellite's motion causes the receiver to move from the footprint of a beam transmitted by one satellite into the footprint of a beam transmitted by a second satellite. Each switch from one footprint to another creates a "handover" event analogous to that which occurs when a traditional cellular phone travels from one cell to another. Handovers are undesirable because

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they can cause interruptions in signal transmission and reception. Rouffet's application discloses technology to reduce the number of handovers between beams transmitted by the same satellite. In particular, Rouffet eliminates handovers caused solely by the satellite's motion. To accomplish this goal, Rouffet changes the shape of the beam transmitted by the satellite's antenna. Rouffet's satellites transmit fan-shaped beams. A fan beam has an elliptical footprint. Rouffet aligns the long axis of his beams parallel to the direction of the satellite's motion across the Earth's surface. By elongating the beam's footprint in the direction of satellite travel, Rouffet's invention ensures that a fixed point on the Earth's surface likely will remain within a single footprint until it is necessary to switch to another satellite. Because Rouffet's invention does not address handovers caused by the motion of the receiver across the Earth's surface, his arrangement reduces, but does not eliminate, handovers. Figure 3 from the application shows the footprints 12 from six beams aligned in the direction of satellite motion 15:



The application contains ten claims that stand or fall as a group. Claim 1 is representative:

A low orbit satellite communications system for mobile terminals, wherein the communications antenna system of each satellite provides isoflux coverage made up of a plurality of fan beams that are elongate in the travel direction of the satellite.

The examiner initially rejected Rouffet's claims as unpatentable over U.S. Pat. No. 5,199,672 (King) in view of U.S. Pat. No. 4,872,015 (Rosen) and a conference report entitled "A Novel Non-Geostationary Satellite Communications System," *Conference Record*, International Conference on Communications, 1981 (Ruddy). On appeal to the Board, the examiner added an alternative ground for rejection, holding that the claims were obvious over U.S. Pat. No. 5,394,561 (Freeburg) in view of U.S. Pat. No. 5,170,485 (Levine).

On April 16, 1997, the Board issued its decision. Because Rouffet had specified that the claims would stand or fall as a group based on the patentability of claim 1, the Board limited its opinion to that claim. The Board unanimously determined that the examiner had properly rejected claim 1 as obvious over King in view of Rosen and Ruddy. The Board, on a split vote, also affirmed the rejection over Freeburg in view of Levine.

II

To reject claims in an application under section 103, an examiner must show an un rebutted *prima facie* case of obviousness. See *In re Deuel*, 51 F.3d 1552, 1557, 34 USPQ2d 1210, 1214 (Fed. Cir. 1995). In the absence of a proper *prima facie* case of

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obviousness, an applicant who complies with the other statutory requirements is entitled to a patent. See *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). On appeal to the Board, an applicant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness. See *id.*

While this court reviews the Board's determination in light of the entire record, an applicant may specifically challenge an obviousness rejection by showing that the Board reached an incorrect conclusion of obviousness or that the Board based its obviousness determination on incorrect factual predicates. This court reviews the ultimate determination of obviousness as a question of law. See *In re Lueders*, 111 F.3d 1569, 1571, 42 USPQ2d 1481, 1482 (Fed. Cir. 1997). The factual predicates underlying an obviousness determination include the scope and content of the prior art, the differences between the prior art and the claimed invention, and the level of ordinary skill in the art. See *Monarch Knitting Mach. Corp. v. Salzer Morat GmbH*, 139 F.3d 877, 881, 45 USPQ2d 1977, 1981 (Fed. Cir. 1998). This court reviews the Board's factual findings for clear error. See *In re Zurko*, 142 F.3d 1447, 1449, 46 USPQ2d 1691, 1693 (Fed. Cir. 1998) (in banc); *Lueders*, 111 F.3d at 1571-72. "A finding is clearly erroneous when, although there is evidence to support it, the reviewing court on the entire evidence is left with the definite and firm conviction that a mistake has been committed." *In re Graves*, 69 F.3d 1147, 1151, 36 USPQ2d

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1697, 1700 (Fed. Cir. 1995) (quoting *United States v. United States Gypsum Co.*, 333 U.S. 364, 395 [76 USPQ 430] (1948)).

The secondary considerations are also essential components of the obviousness determination. See *In re Emert*, 124 F.3d 1458, 1462, 44 USPQ2d 1149, 1153 (Fed. Cir. 1997) ("Without Emert providing rebuttal evidence, this *prima facie* case of obviousness must stand."). This objective evidence of nonobviousness includes copying, long felt but unsolved need, failure of others, see *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 [148 USPQ 459] (1966), commercial success, see *In re Huang*, 100 F.3d 135, 139-40, 40 USPQ2d 1685, 1689-90 (Fed. Cir. 1996), unexpected results created by the claimed invention, unexpected properties of the claimed invention, see *In re Mayne*, 104 F.3d 1339, 1342, 41 USPQ2d 1451, 1454 (Fed. Cir. 1997); *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936-37 (Fed. Cir. 1990), licenses showing industry respect for the invention, see *Arkie Lures, Inc. v. Gene Larew Tackle, Inc.*, 119 F.3d 953, 957, 43 USPQ2d 1294, 1297 (Fed. Cir. 1997); *Pentec, Inc. v. Graphic Controls Corp.*, 776 F.2d 309, 316, 227 USPQ 766, 771 (Fed. Cir. 1985), and skepticism of skilled artisans before the invention, see *In re Dow Chem. Co.*, 837 F.2d 469, 473, 5 USPQ2d 1529, 1532 (Fed. Cir. 1988). The Board must consider all of the applicant's evidence. See *Oetiker*, 977 F.2d at 1445 ("An observation by the Board that the examiner made a *prima facie* case is not improper, as long as the ultimate determination of patentability is made on the entire record."); *In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). The court reviews factual conclusions drawn from this evidence for clear error. Whether the evidence presented suffices to rebut the *prima facie* case is part of the ultimate

conclusion of obviousness and is therefore a question of law.

When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references. *See In re Geiger*, 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987). Although the suggestion to combine references may flow from the nature of the problem, *see Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed. Cir. 1996), the suggestion more often comes from the teachings of the pertinent references, *see In re Sernaker*, 702 F.2d 989, 994, 217 USPQ 1, 5 (Fed. Cir. 1983), or from the ordinary knowledge of those skilled in the art that certain references are of special importance in a particular field. *see Pro-Mold*, 75 F.3d at 1573 (citing *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 n.24, 227 USPQ 657, 667 n.24 (Fed. Cir. 1985)). Therefore, "[w]hen determining the patentability of a claimed invention which combines two known elements, 'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.'" *See In re Beattie*, 974 F.2d 1309, 1311-12, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992) (quoting *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1462, 221 USPQ 481, 488 (Fed. Cir. 1984)).

III

The parties agree that the five references asserted by the examiner are in the same field of endeavor as the invention. The parties also agree that the pertinent level of skill in the art -- design of satellite communications systems -- is high. On appeal, Rouffet asserts that the examiner and the Board erred by improperly combining references to render the claimed invention obvious.

The Combination of King, Rosen, and Ruddy

The Board first affirmed the rejection of Rouffet's claims over a combination of King, Rosen, and Ruddy. King discloses a system for launching a plurality of satellites into low Earth orbits from a single launch vehicle. Rosen teaches a geostationary satellite that uses a plurality of fan beams with their long axes oriented in an east-west direction to communicate with mobile and fixed terminals on the Earth.

The final, and most important, reference in this combination is Ruddy. Ruddy describes a television broadcast system that uses a series of satellites to retransmit signals sent from a ground station over a wide area. Rather than using a geostationary orbit, Ruddy teaches the use of a series of satellites in Molniya orbits. A satellite in a Molniya orbit always follows the same path through the sky when viewed from a fixed point on the ground. Viewed from the Earth, the orbital path includes a narrow, elliptical apogee loop. In order to transmit to these moving satellites from a ground station, Ruddy uses a fan beam with a long axis aligned with the long axis of the orbit's apogee loop. This alignment places the entire apogee loop within the footprint of the beam and eliminates the need for the ground station's antenna to track the satellite's motion around the apogee loop. Ruddy further teaches orbit parameters

and spacing of multiple satellites to ensure that a satellite is always in the loop to receive and rebroadcast signals from the Earth station.

King and Rosen together teach the use of a network of satellites in low Earth orbit. Thus, Ruddy becomes the piece of the prior art mosaic that shows, in the reading of the Board, the use of "a plurality of fan beams that are elongate in the travel direction of the satellite." Ruddy, however, is different from the claimed invention in several respects. Specifically, the application claims the projection of multiple elliptical fan-shaped footprints from the satellite to the ground. *See* Claim 1, *supra*, *see also* Application at 6, lines 9-11 ("In addition, in this system, the geometrical shape of the beams 12 is changed: instead of being circular they are now elongate ellipses."). The application's written description further teaches that the invention's fan-shaped satellite beams will minimize handovers. *See id.* at lines 11-16 ("This considerably increases call durations between handovers.").

In contrast, Ruddy teaches that a ground station may use a single fan-shaped beam to transmit to a satellite in a unique Molniya orbit. The ground station transmits a beam into which a series of satellites in Molniya orbits will successively enter. At least two differences are evident: the application teaches projection of multiple beams from a satellite to the Earth, while Ruddy teaches projection of a single beam from the Earth to satellites. Moreover to the extent Ruddy contains a teaching about handovers, its teachings focus on use of the unique Molniya orbit to ensure that a satellite always falls within the beam transmitted by the ground station.

These differences suggest some difficulty in showing a *prima facie* case of obviousness. The Board, however, specifically found that artisans of ordinary skill in this field of art would know to shift the frame of reference from a ground station following a satellite to a satellite transmitting to the ground. According proper deference to the Board's finding of a lofty skill level for ordinary artisans in this field, this court discerns no clear error in the Board's conclusion that these differences would not preclude a finding of obviousness. While Ruddy does not expressly teach alignment of the fan beam with the apparent direction of the satellite's motion, this court perceives no clear error in the Board's determination that Ruddy would suggest such an alignment to one of skill in this art. Therefore, the Board did not err in finding that the combination of King, Rosen, and Ruddy contains all of the elements claimed in Rouffet's application.

[1] However, the Board reversibly erred in determining that one of skill in the art would have been motivated to combine these references in a manner that rendered the claimed invention obvious. Indeed, the Board did not identify any motivation to choose these references for combination. Ruddy does not specifically address handover minimization. To the extent that Ruddy at all addresses handovers due to satellite motion, it addresses this subject through the selection of orbital parameters. Ruddy does not teach the choice of a particular shape and alignment of the beam projected by the satellite. Thus Ruddy addresses the handover problem with an orbit selection, not a beam shape. The Board provides no reasons that one of ordinary skill in this art, seeking to minimize handovers due to satellite motion, would combine Ruddy with Rosen and King in a manner that would render the claimed invention obvious.

Obviousness is determined from the vantage point of a hypothetical person having ordinary skill in the art to which the patent pertains. *See* 35 U.S.C. Section 103(a). This legal construct is akin to the "reasonable person" used as a reference in negligence

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determinations. The legal construct also presumes that all prior art references in the field of the invention are available to this hypothetical skilled artisan. See *In re Carlson*, 983 F.2d 1032, 1038, 25 USPQ2d 1207, 1211 (Fed. Cir. 1993).

As this court has stated, "virtually all [inventions] are combinations of old elements." *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 698, 218 USPQ 865, 870 (Fed. Cir. 1983); see also *Richdel, Inc. v. Simspool Corp.*, 714 F.2d 1573, 1579-80, 219 USPQ 8, 12 (Fed. Cir. 1983) ("Most, if not all, inventions are combinations and mostly of old elements."). Therefore an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue.

Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be "an illogical and inappropriate process by which to determine patentability." *Sensonic, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570, 38 USPQ2d 1551, 1554 (Fed. Cir. 1996).

To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to

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show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.

[2] This court has identified three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. In this case, the Board relied upon none of these. Rather, just as it relied on the high level of skill in the art to overcome the differences between the claimed invention and the selected elements in the references, it relied upon the high level of skill in the art to provide the necessary motivation. The Board did not, however, explain what specific understanding or technological principle within the knowledge of one of ordinary skill in the art would have suggested the combination. Instead, the Board merely invoked the high level of skill in the art. If such a rote invocation could suffice to supply a motivation to combine, the more sophisticated scientific fields would rarely, if ever, experience a patentable technical advance. Instead, in complex scientific fields, the Board could routinely identify the prior art elements in an application, invoke the lofty level of skill, and rest its case for rejection. To counter this potential weakness in the obviousness construct, the suggestion to combine requirement stands as a critical safeguard against hindsight analysis and rote application of the legal test for obviousness.

Because the Board did not explain the specific understanding or principle within the knowledge of a skilled artisan that would motivate one with no knowledge of Rouffet's invention to make the combination, this court infers that the examiner selected these references with the assistance of hindsight. This court forbids the use of hindsight in the selection of references that comprise the case of obviousness. See *In re Gorman*,

933 F.2d 982, 986, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). Lacking a motivation to combine references, the Board did not show a proper *prima facie* case of obviousness. This court reverses the rejection over the combination of King, Rosen, and Ruddy.

The Combination of Freeburg and Levine

Freeburg teaches a cellular radiotelephone system based on a constellation of low Earth orbit satellites that use conical beams to transmit from the satellite to both fixed and mobile Earth stations. Levine teaches an Earth-based cellular radio system that uses fan beams broadcast from antenna towers. Levine's elliptical footprints are aligned with the road grid. To increase the capacity of traditional ground-based systems through frequency reuse techniques, Levine teaches the use of antennas that broadcast signals with smaller footprints than the prior art system. Thus, Levine actually increases the number of overlap regions between cells and, hence, the number of potential handovers. Figure 1 of the Levine patent illustrates its alignment of beam footprints:



As a mobile unit (e.g., a driver using a car phone) moves through a succession of overlapping zones, Levine uses selection algorithms to determine which of the cells is aligned with the travel direction of the mobile unit. These algorithms then select this cell for use while continually monitoring intersecting cells in the event that the mobile unit changes direction.

Once again, this court notes significant differences between the teachings of the application and the Levine-Freeburg combination. The critical Levine reference again involves a beam from an Earth station without any reference to the "travel direction of [a] satellite." Moreover, Levine actually multiplies the number of potential handovers and then uses software to sort out the necessary handovers from the unnecessary. However, the Board explains the reasons that one possessing the lofty skills characteristic of this field would know to account for the differences between the claimed invention and the prior art combination. This court discerns no clear error in that reliance on the considerable skills in this field.

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[3] This court does, however, discern reversible error in the Board's identification of a motivation to combine Levine and Freeburg. In determining that one of skill in the art would have had motivation to combine Levine and Freeburg, the Board noted that "[t]he level of skill in the art is very high." As noted before, this observation alone cannot supply the required suggestion to combine these references. The Board posits that the high level of skill in the art overcomes the absence of any actual suggestion that one could select part of the teachings of Levine for combination with the satellite system disclosed by Freeburg.

As noted above, the suggestion to combine requirement is a safeguard against the use of hindsight combinations to negate patentability. While the skill level is a component of the inquiry for a suggestion to combine, a lofty level of skill alone does not suffice to supply a motivation to combine. Otherwise a high level of ordinary skill in an art field would almost always preclude patentable inventions. As this court has often noted,

invention itself is the process of combining prior art in a nonobvious manner. See, e.g., *Richdel*, 714 F.2d at 1579; *Environmental Designs*, 713 F.2d at 698. Therefore, even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. Cf. *Gechter v. Davidson*, 116 F.3d 1454, 43 USPQ2d 1030 (Fed. Cir. 1997) (explaining that the Board's opinion must describe the basis for its decision). In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious.

The Board's naked invocation of skill in the art to supply a suggestion to combine the references cited in this case is therefore clearly erroneous. Absent any proper motivation to combine part of Levine's teachings with Freeburg's satellite system, the rejection of Roufflet's claim over these references was improper and is reversed.

IV

The Board reversibly erred in determining that there was a motivation to combine either the teachings of King, Rosen, and Ruddy or of Freeburg and Levine in a manner that would render the claimed invention obvious. Because this predicate was missing in each case, the Board did not properly show that these references render the claimed invention obvious. Therefore this court reverses the Board's decision upholding the rejection of Roufflet's claims. In light of this disposition, Roufflet's pending motion to remand the case to the Board for further consideration is denied as moot.

COSTS

Each party shall bear its own costs.

REVERSED .

- End of Case -

FULL TEXT OF CASES (USPQ2D)

All Other Cases

**Ruiz v. A.B. Chance Co., 69 USPQ2d 1686 (CA FC
2004)**

**69 USPQ2D 1686
Ruiz v. A.B. Chance Co.**

U.S. Court of Appeals Federal Circuit

No. 03-1333

Decided January 29, 2004

Headnotes

PATENTS

**[1] Patentability/Validity — Obviousness — Combining references
(\$115.0905)**

Obviousness analysis requires court to assess invention as whole to determine whether there was suggestion or motivation to combine prior art references, without engaging in improper “hindsight” determination, but finding of obviousness does not require existence of express, written motivation to combine in

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prior art, since motivation to combine may be found in nature of

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problem to be solved, leading inventors to look to references relating to possible solutions to that problem.

**[2] Patentability/Validity — Obviousness — Combining references
(§115.0905)**

**Patentability/Validity — Obviousness — Commercial success
(§115.0908)**

Federal district court did not clearly err in concluding that it would have been obvious to combine screw anchors of prior art method with metal brackets used in prior art patents to achieve invention of patents for method of stabilizing or “underpinning” building foundations, even though there was no express written motivation to combine references in prior art, since each cited reference addresses exact same narrow problem of underpinning existing structural foundations, since there is evidence that prior artisans' work showed that screw anchors worked better than straight push piers used in original metal bracket method, and that it was widely known at time of prior art that underpinning system requires means of connecting foundation to load-bearing member, and since record supports court's discounting of defendant's commercial success as evidence of nonobviousness.

Particular Patents

**Particular patents — General and mechanical — Building
stabilization**

5,139,368, Hamilton, Hoyt, Halferty, and Odom, method of underpinning existing structures using screw anchors, judgment of invalidity affirmed.

5,171,107, Hamilton, Hoyt, Halferty, and Odom, method of underpinning existing structures using screw anchors, judgment of invalidity affirmed.

Case History and Disposition

Appeal from the U.S. District Court for the Eastern District of Missouri, Perry, J.

Action by Richard Ruiz and Foundation Anchoring Systems Inc. against A.B. Chance Co. for declaratory judgment that defendant's

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patents are invalid and not infringed, and for discrimination pursuant to 42 U.S.C. §1981, breach of contract, breach of implied duty of good faith and fair dealing, promissory and equitable estoppel, and tortious interference with contract and prospective business relations, in which defendant counterclaimed alleging infringement of its patents. District court granted summary judgment for defendant on nonpatent claims, and at trial found that patents were infringed, but that patent claims at issue were invalid for obviousness. Judgment of invalidity was vacated and remanded (57 USPQ2d 1161). On remand, district court again found claims invalid as obvious, and defendant appealed. Affirmed.

Prior decision: 57 USPQ2d 1161.

Attorneys:

Matthew A. Rosenberg, of Blumenfeld, Kaplan & Sandweiss, St. Louis, Mo., for plaintiffs-appellees.

John H. Quinn III and Andrew B. Mayfield, of Armstrong Teasdale, St. Louis, for defendant-appellant.

Judge:

Before Newman, Michel, and Rader, circuit judges.

Opinion Text

Opinion By:

Rader, J.

On remand from this court's decision in *Ruiz v. A.B. Chance Company*, 234 F.3d 654 [57 USPQ2d 1161] (Fed. Cir. 2000), the United States District Court for the Eastern District of Missouri found defendant-appellant A.B. Chance Company's (Chance) patented underpinning system obvious under 35 U.S.C. §103. Because the district court made no clear error in its factual determinations concerning the motivation to combine the prior art teachings and the merit of Chance's asserted secondary considerations, this court affirms.

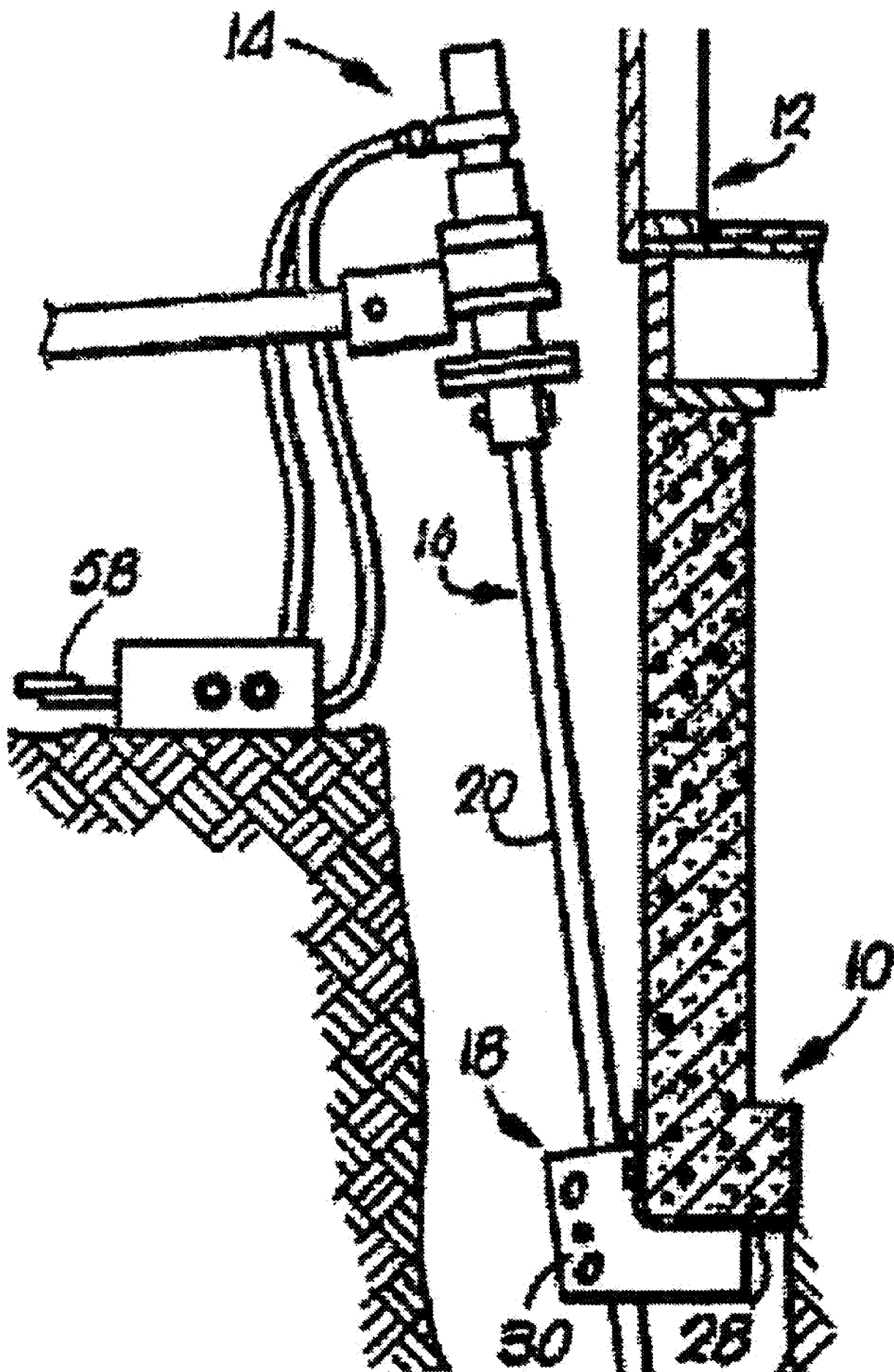
I.

Since about 1970, Chance has manufactured screw anchors, also called helical piers, for use in supporting and stabilizing electrical transmission towers. Screw anchors are elongated shafts with an earth-boring (screw) tip and a transversely extending load-bearing member. In 1988, Chance extended its expertise in stabilizing slumping structures into the residential and commercial building markets. Chance used screw anchors with a metal bracket to underpin these building foundations. The Chance

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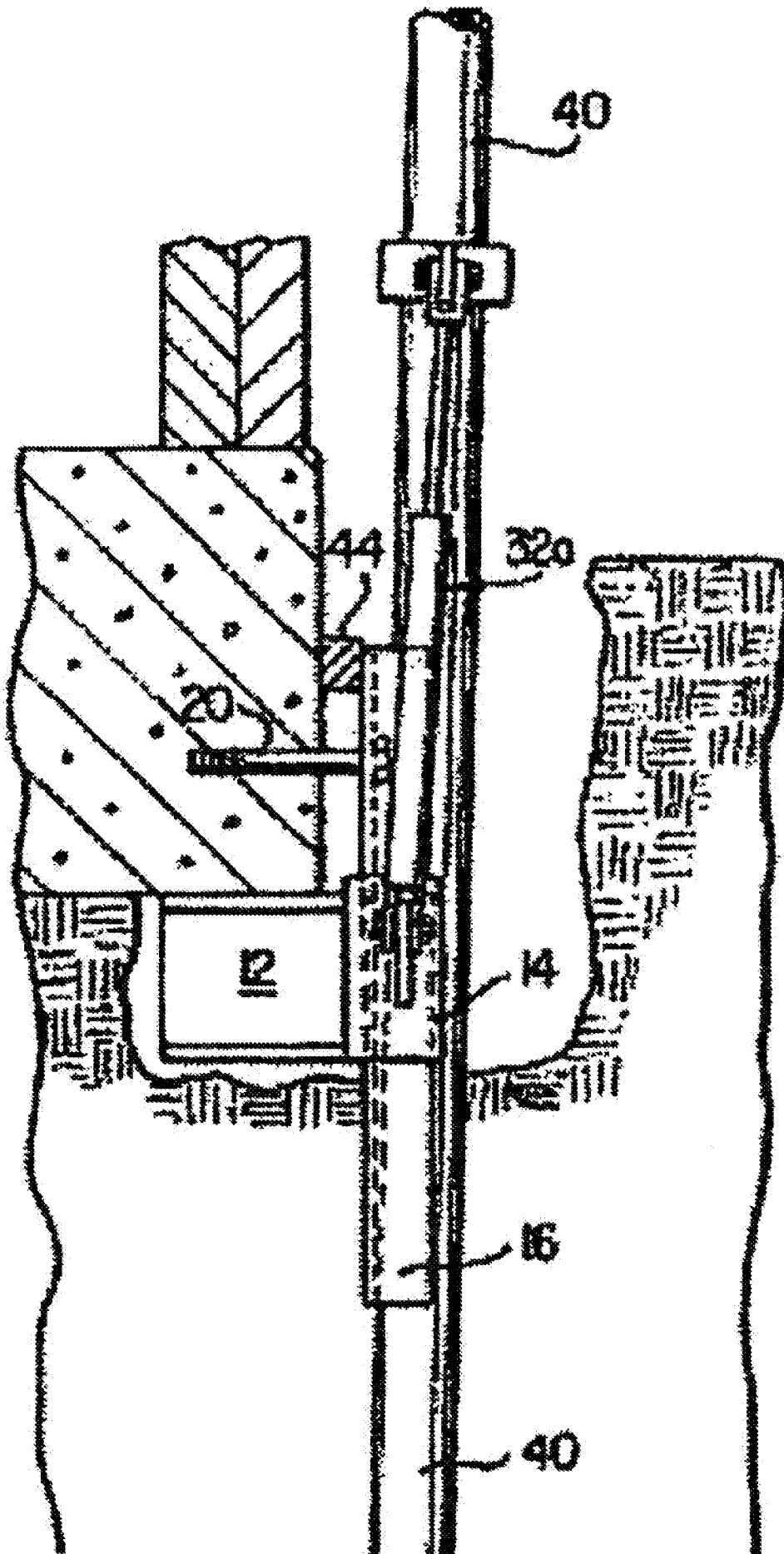
underpinning method places the screw anchor adjacent to the footing and rotates the screw anchor to bore beneath the footing. When resistance to rotation of the screw anchor reaches a specified point, Chance attaches a metal bracket (designated as 30 in the Figure below) to the slouching foundation to transfer the building load onto the screw anchor. The United States Patent and Trademark Office issued U.S. Patent Nos. 5,139,368 and 5,171,107 to Chance in 1992 covering this screw anchor system. Figure 5 in the '107 patent shows the technology:

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Appellees Richard Ruiz and his company Foundation Anchoring Systems, Inc. (collectively "Ruiz") became distributors for Chance's underpinning system. During the early 1990s, Ruiz also formed various other anchoring companies and marketed systems that competed with the Chance system. In February 1997, Chance terminated Ruiz's distributorship. Thereafter, Ruiz began marketing an underpinning system with screw anchors and metal brackets. This new system used components from other manufacturers. Ruiz filed suit against Chance in August of that same year alleging various non-patent claims, including discrimination, breach of contract, tortious interference with contract and business relations, and breach of fiduciary duty of good faith and fair dealing. Ruiz also filed for a declaratory judgment that its new underpinning system does not infringe Chance's patents and that the patents are invalid. Chance filed a counterclaim for patent infringement.

The validity question focuses on several prior art references. During the late 1980s, Richard Fuller and Stan Rupiper used screw anchors for underpinning existing structural foundations. Fuller and Rupiper used a concrete haunch, not a metal bracket, to transfer the load of the foundation to the screw anchor (the "Fuller-Rupiper method"). Gregory's U.S. Patent Nos. 4,911,580 and 4,765,777 claim an apparatus and system for underpinning structural foundations using a push pier and a metal bracket. In the Gregory system, the metal bracket transfers the foundation load to the push pier, which is driven into the ground to supply the necessary foundational support. The push pier relies on soil friction to supply that support. Figure 6 of the '580 patent shows this technology:



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The scope of the claims in this case is not at issue in this appeal, because the parties agree that the claims are infringed or invalidated by the use of a screw anchor in conjunction with a metal bracket to underpin a foundation. Additional information concerning the claims and the other aspects of this case appear in this court's opinion in *Ruiz v. A.B. Chance Co.*, 234 F.3d 654 [57 USPQ2d 1161] (Fed. Cir. 2000). Examination of the prior art

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shows that the Fuller-Rupiper method discloses the screw anchor component of the claims; the Gregory system discloses the metal bracket component in the claims. Thus, this appeal is properly focused on the motivation to combine those teachings, as well as any secondary considerations that might inform the obviousness analysis.

The district court granted summary judgment in favor of Chance on all of Ruiz's non-patent claims in April 1999. On the patent claims, the district court held a *Markman* hearing to construe the claims and a bench trial to decide the issues of infringement and validity. At the time of trial, the scope of the case had narrowed to focus on claims 1-4 and 6-8 of the '368 patent and claims 1-4 and 6-8 of the '107 patent. After the trial, the district court entered its judgment from the bench that Ruiz's product infringes the patent claims to the tune of \$540,000 in damages. Nonetheless, the trial court determined that the claims are invalid under 35 U.S.C. §103 in light of the Gregory patents and the Fuller-Rupiper method.

This court heard the appeal from that judgment and affirmed every holding of the district court except the finding of obviousness. In *Ruiz*, 234 F.3d at 660, this court remanded the case to the district court for further examination of obviousness. This court issued the following instructions:

On remand, we instruct the district court to make specific *Graham* findings on: 1) the reason, suggestion, or motivation present in the prior art, in the knowledge of one of skill in the art, or in the problem of foundation settling which clearly and particularly would lead one of ordinary skill in the art to combine screw anchors with metal brackets; 2) the level of ordinary skill in the art; and 3) whether, and to what extent, evidence of secondary consideration, such as commercial success, long felt but unresolved need, failure of others, copying, and unexpected results, is probative in the obviousness analysis. *Id.*

The district court invited additional briefing and oral argument on the remand issues. Having reconsidered the evidence of the case, the district court again found the relevant claims invalid as obvious and issued an opinion outlining its factual findings according to this court's instructions. Of particular significance, the district court found the motivation to combine the teachings of the Gregory patents and the Fuller-Rupiper method in the nature of the problem of underpinning foundations itself, explaining:

The Rupiper method and the Gregory patent can be combined in either of two ways to reach the same result as the method covered by the patents in issue here: by replacing the concrete haunch of the Rupiper method with the bracket of the Gregory patent, or

by replacing the straight piling of the Gregory patent with the screw anchor of the Rupiper method. The evidence in this case showed that there was reason, suggestion or motivation to make these combinations. ... The problem is the same: how to underpin an unstable foundation of an existing building.

The district court also discounted Chance's proffered objective evidence of commercial success and skepticism of experts as weak. Specifically, the district court found that the alleged skepticism of Chance's system by Rupiper was merely an acknowledgement that Rupiper's concrete haunch worked better than a metal bracket in seismic areas, such as California. The record indeed does not show that Rupiper doubted that Chance's system would work in general. In addition, the district court attributed Chance's commercial success to its background and experience in screw anchors rather than any inventive features of the screw anchor-metal bracket system as a whole.

Chance now appeals again, arguing that the district court, as it did in its original judgment, employed hindsight to find obviousness. Specifically, this appeal involves two challenges to the district court's obviousness determination: 1) whether the district court clearly erred in finding an implied motivation to combine the prior art teachings in the nature of the problem of underpinning existing foundations, and 2) whether the district court clearly erred in discounting Chance's evidence of secondary considerations. Jurisdiction over this appeal is proper under 28 U.S.C. § 1295.

II.

Section 103 of title 35 of the United States Code states:

A patent may not be obtained ... if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

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35 U.S.C. §103(a) (2000).

In making the assessment of differences, section 103 specifically requires consideration of the claimed invention "as a whole." Inventions typically are new combinations of existing principles or features. *Envil. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 698 [218 USPQ 865] (Fed. Cir. 1983) (noting that "virtually all [inventions] are combinations of old elements."). The "as a whole" instruction in title 35 prevents evaluation of the invention part by part. Without this important requirement, an obviousness assessment might break an invention into its component parts (A + B + C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious. This form of hindsight reasoning, using the invention as a roadmap to find its prior art components, would discount the value of combining various existing features or principles in a new way to achieve a new result -- often the very definition of invention.

Section 103 precludes this hindsight discounting of the value of new combinations by requiring assessment of the invention as a whole. This court has provided further assurance of an “as a whole” assessment of the invention under §103 by requiring a showing that an artisan of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would select the various elements from the prior art and combine them in the claimed manner. In other words, the examiner or court must show some suggestion or motivation, before the invention itself, to make the new combination. *See In re Rouffet*, 149 F.3d 1350, 1355-56 [47 USPQ2d 1453] (Fed. Cir. 1998).

While the ultimate determination of obviousness is a legal conclusion reviewed by this court without deference, that determination always entails various factual findings that this court reviews for clear error following a bench trial. *See Weatherchem Corp. v. J.L. Clark, Inc.*, 163 F.3d 1326, 1332 [49 USPQ2d 1001] (Fed. Cir. 1998). The clear error standard permits reversal only when this court is left with a “definite and firm conviction” that the district court was in error. *Ambil Enters. Ltd. v. Wawa, Inc.*, 81 F.3d 1554, 1562 [38 USPQ2d 1471] (Fed. Cir. 1996).

This case deals with a challenge to the district court’s conclusion on two of the underlying factual determinations in its obviousness analysis. Accordingly, this court will review for clear error the district court’s conclusions regarding objective, secondary considerations, *see Pro-Mold v. Great Lakes Plastics*, 75 F.3d 1568, 1572 [37 USPQ2d 1626] (Fed. Cir. 1996), and whether a motivation to combine the teachings in the prior art references was shown, *see Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1348 [53 USPQ2d 1580] (Fed. Cir. 2000).

The district court in this case presided over a bench trial and reconsidered the evidence on remand. Chance’s principal argument is that the district court clearly erred in finding a motivation to combine the teachings in the Gregory patents with the Fuller-Rupiper method. Chance cites this court’s precedent that warns district courts about the risk of hindsight reconstruction to find an invention obvious where the invention at issue involves relatively simple technology. *See McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351 [60 USPQ2d 1001] (Fed. Cir. 2001). Accordingly, Chance argues that the district court utilized hindsight to find that a person of ordinary skill would have been motivated to combine the prior art teachings.

[1] To the contrary, the record in this case supports the trial court’s findings. While this court indeed warns against employing hindsight, its counsel is just that – a warning. That warning does not provide a rule of law that an express, written motivation to combine must appear in prior art references before a finding of obviousness. Stated differently, this court has consistently stated that a court or examiner may find a motivation to combine prior art references in the nature of the problem to be solved. *See Pro-Mold*, 75 F.3d at 1573; *Display Techs., Inc. v. Paul Flun Ideas, Inc.*, 282 F.3d 1340, 1346-47 (Fed. Cir. 2002); *In re Huang*, 100 F.3d 135, 139 n.5 [40 USPQ2d 1685] (Fed. Cir. 1996). This form of motivation to combine evidence is particularly relevant with simpler mechanical

technologies.

[2] This record shows that the district court did not use hindsight in its obviousness analysis, but properly found a motivation to combine because the two references address precisely the same problem of underpinning existing structural foundations. Moreover the record supports the district court's factual finding that Fuller's and Rupiper's work showed that screw anchors worked better than straight push piers. In fact, the evidence shows that Rupiper introduced Chance to the use of screw anchors in underpinning building foundations. Chance then added a metal bracket to the screw anchor.

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The record also supports the district court's conclusion that artisans knew that a foundation underpinning system requires a means of connecting the foundation to the load-bearing member. The Gregory patents teach the use of a metal bracket to connect a foundation to a straight pier, and testimony at trial showed that the need for a connecting element was widely known. Thus, the district court could properly conclude on this record, without being clearly in error, that a person of ordinary skill would be led to combine the screw anchor in the Fuller-Rupiper method with the metal bracket in the Gregory system to underpin an existing building foundation.

This record, it is true, does not feature an express written teaching in the art to make this combination. On this record, however, that is not fatal to the district court's obviousness determination. As noted earlier, this court has repeatedly stated that the motivation to combine the teachings in the prior art may "come from the nature of a problem to be solved, leading inventors to look to references relating to possible solutions to that problem." *Pro-Mold*, 75 F.3d at 1573. The district court in this case applied that settled law. The district court, sitting as a finder of fact, weighed the evidence and found that, because the prior art references address the narrow problem of underpinning existing building foundations, a person seeking to solve that exact same problem would consult the references and apply their teachings together. Thus the district court's conclusion is perfectly legitimate when the evidence supports it, as it does here.

Chance's argument amounts to little more than its own alternative view of the evidence. While the record does contain some evidence against the district court's finding, such evidence is not overwhelming by any means. In addition, the district court in this case did not simply discount all contrary evidence and bolster a meager amount of evidence to reach a preformed conclusion. In fact, the district court discounted and discredited some testimony that actually supported its ultimate conclusion. For instance, the trial court dismissed the testimony of Robert Jones, a Chance distributor, that he would have made the combination. The district court declined to credit Mr. Jones' testimony because he exhibited far more than an ordinary level of skill in this art. The trial court's careful consideration of Mr. Jones' evidence shows further that it performed a detailed and reasoned analysis of the evidence, rather than a conclusion-oriented discussion that typically accompanies a hindsight analysis. In short, the record in this

case does not approach the evidence necessary to leave this court with a firm conviction that the district court committed clear error in its factual finding of a motivation to combine the Fuller-Rupiper and Gregory teachings.

Finally, the record also supports the district court's discounting of Chance's evidence of secondary considerations. The record supports the trial court's finding that any commercial success was not due to Chance's alleged unique combination, but rather due to Chance's experience with screw anchors combined with being the first large screw anchor manufacturer to enter the underpinning market. The district court did not clearly err in reaching this conclusion, nor in concluding that the evidence of skepticism was weak.

III.

Based on the above analysis, this court holds that the district court did not clearly err in finding a motivation to combine the prior art references in the nature of the problem at issue. In addition, this court holds that the district court did not clearly err in discounting Chance's evidence of secondary considerations. Accordingly, this court affirms the judgment of the district court.

COSTS

Each party shall bear its own costs.

AFFIRMED

- End of Case -

RELATED PROCEEDINGS APPENDIX

None.